International Marine Engineering

Published Monthly by ALDRICH PUBLISHING CO.

17 BATTERY PLACE, NEW YORK — 31 CHRISTOPHER ST., LONDON, E. C.

H. L. Aldrich, President and Treasurer
Assoc. Member of Council, Soc. N. A. and M. E.

George Slate, Vice-President
E. L. Sumner, Secretary

E. J. P. Benn, Director and Publisher
Associate Inst. N. A.

Edited by H. H. Brown, A. M. Inst. N. A.
Member Soc. N. A. and M. E.

Vol. XVIII — NOVEMBER, 1913 — No. 11

Western River Steamers, Engines and Boilers

BY E. A. BURNSIDE

The flat-bottom stern-wheel steamers used on the Western and Southern rivers of the United States are sometimes held up to scorn by seafaring men in the Eastern States and in foreign countries, on account of both the unusual style of naval architecture and the apparent lack of progress made by the builders in the design of hulls and machinery.

necessity for cheaply-constructed boats was a very important consideration, and it must be admitted that these conditions were met and complied within a remarkably successful manner, resulting in the development of a type of stern-wheel steamer which has stood the test of many years' service without any need for radical improvements.

FIG. 1.—TYPICAL STEEL HULL OHIO RIVER TOWBOAT. TOWING CAPACITY—WITH CURRENT—32 BARGES OF 550 TONS EACH

It is true that changes and progress have been slow in the construction of steamboats on the Western rivers, and they will be slow for years to come; for the reason that the early designers and builders of river steamers built exceedingly well, considering the materials at their disposal. They built to meet the special needs of the traffic then offered, and it required no little ingenuity to meet the restrictions imposed by the changes in the navigable stages of water in the rivers. In the early days the condition of the rivers for navigation was general dangerous, and this holds true even in late years, as will be realized by an inspection of some of the photographs accompanying this article. With such conditions to meet, the

Towboats

Western river steamboats are used as packet boats, freighters and for towing purposes. Most of the steamboat tonnage now afloat on the Western rivers is in the form of towboats, and by far the largest part of the freight moved on the rivers is handled by towboats. The majority of the towboats are stern-wheel steamers of the same general form as were built forty years ago. These boats are also engined and boilered with the same general type of machinery as was used at that time, and it should be noted that the engines and boilers of this type are doing good work and showing a combined boiler and engine efficiency that would surprise many marine engine

builders, who would otherwise be disposed to ridicule the so-called obsolete types of machinery which are still used to a great extent on the Western rivers.

Improvements in Hull Construction

The only particular change in hull construction of wooden towboats has been the change from "skag" sterns to the scow or round form of stern, which is sometimes called a "goose" stern. The "skag" stern was a formation of the hull at the stern of the boat, with deadwood timbers connecting the rudder posts to which the two wing rudders were fastened. The "skag" type permitted the use of but one or two balanced rudders and two wing rudders, the wing rudders being fastened at the foot of the rudder post with no extension of blade forward of the rudder stock. On the other hand, the round form of stern, or "goose stern," permits the use of three or more balanced rudders.

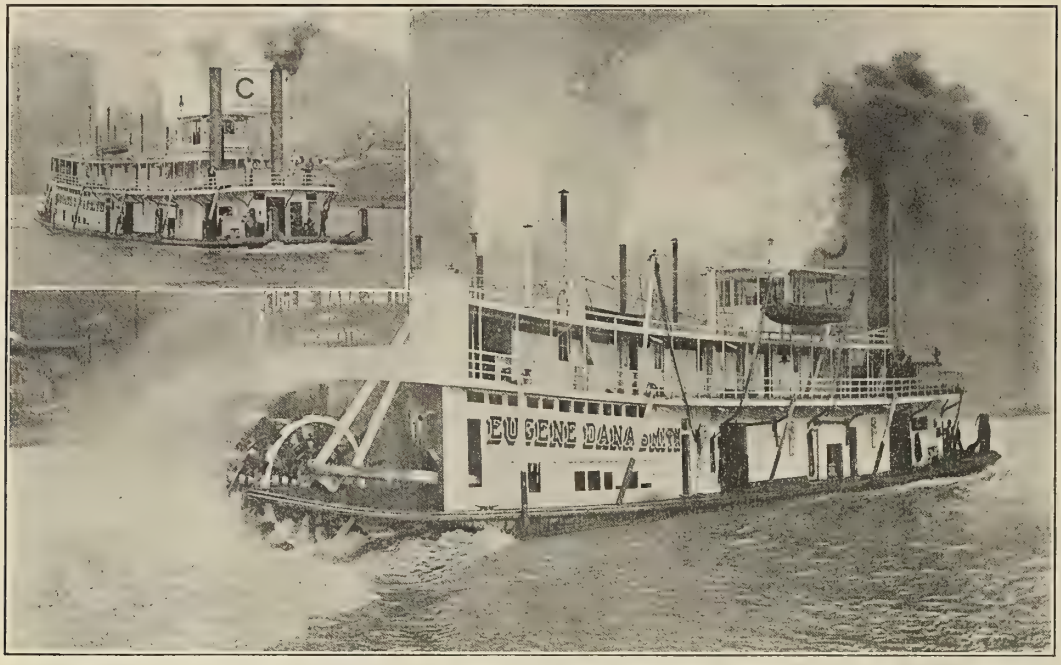


FIG. 2.—VIEWS OF STERN WHEEL TOWBOAT EUGENE DANA SMITH

FIG. 3.—TWIN SCREW TUG IRON DUKE HANDLING BARGES AT A COAL TIPPLE

This change was brought about for the reason that the use of all balanced rudders gave the steamer better handling efficiency in backing or flanking. This was a much desired result in towboats handling large tows, but the fact remains that the old-style "skag" stern towboats, while not handling so well usually as the scow or round-stern boats, nevertheless steered ahead much better and prevented the steamers from "sliding" as much as did the other type of boats.

Tunnel Boats vs. Stern-Wheelers

Attempts have been made to use the tunnel type of screw-propelled shallow draft boats on the Western rivers, and it is claimed by the builders of this type that they will out-flank and out-handle the stern-wheel towboat, but, so far as the writer's observation goes, and from what he has been told, the tunnel type boat will not handle loaded tows down stream, where there is much flanking or difficult handling, as well as the stern-wheel towboats. The average Western river boatmen, owners and pilots alike, have not yet become convinced that the tunnel boats will equal their old-style stern-wheel towboat for such purposes. It is true that tunnel boats, built for special work, have made some remarkable records in the saving of fuel in freight towing on the Mississippi and in Government river improvements, showing maximum power and speed with a minimum draft of water, but, nevertheless, in some respects, and in certain classes of work, it is the writer's opinion that they cannot equal the better class of stern-wheel towboats and will never surpass them.

Remarkable Records of Old-Style Boilers

The old-style Western river steamboat boiler, which is still almost universally used on these boats, has been condemned and maligned and proved by "theorethical calculations" to be very inefficient and wasteful in fuel consumption. It is a matter of fact, however, that a number of watertube and other modern types of marine boilers which have been installed on Western river steamers have in a short time been removed, and the old-time horizontal two, five and six-flue boilers, as the case might be, put back on the steamers. A case in point is that of a towboat owner who has had in use for a year what was claimed to be the most efficient and safest boiler for towboat use, but who is about to remove this boiler and install in its place the old-time horizontal two-flue Western river boiler.

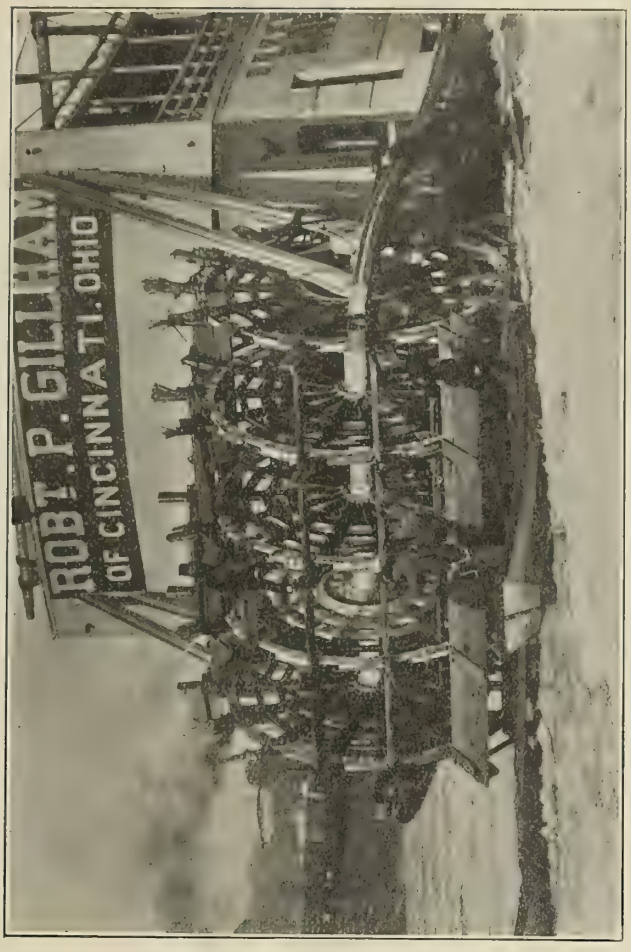


FIG. 5.—REPAIRING WHEEL BROKEN IN ICE GORGE

FIG. 7.—TOW OF COAL BARGES AS USUALLY ARRANGED AHEAD OF THE TOWBOAT

FIG. 4.—ICE OBSTRUCTION AHEAD OF TOW OF COAL BARGES

FIG. 6.—BLASTING AWAY AN ICE OBSTRUCTION

The company with which the writer is associated now has in use one boiler over twenty-two years old of the old horizontal type with two flues, which at times has been forced to its utmost capacity twenty-four hours every day, for as much as sixty days at a stretch, and which in all of the twenty-two years it has been in service has not been out of use over six months' time; yet the cost of repairs on the boiler for this almost continuous service for twenty-two years has not been over $35 (7/5/10). Another battery of six horizontal two-flued boilers on one of the towboats belonging to the same company has been in use for fifteen years and has cost but $6 (1/5/0) for repairs.

The horizontal river type boilers are externally fired, and fire cracking of the laps in the shell plates outside of the rivet holes in the seams over the fires is about the only trouble that is experienced with this type of boiler. Occasionally a boiler is burned by an accumulation of scale, but this fault is often remedied by changing the disposition of the feed water inside the boiler.

Considering the fact that this type of boiler has been in use for three generations; that it meets the requirements of the special class of traffic and type of boats used on the Western rivers; that it is efficient; that it is capable of producing far greater horsepower than its theoretical rating; that it is not excessive in fuel consumption, considering the grade and kind of coal used; that it is reasonable in first cost, and that it is easily accessible for repairs, it seems safe to conclude that it will be many years before any boiler is built that will supplant the old-time two-flued cylindrical boiler for use on the Western river stern-wheel steamers.

The Engines

As is well known, the type of engines used on the stern-wheel steamers is the long-stroke, high-pressure, non-condensing engine equipped with some one of the several various types of valve gear. Many recent boats of this class are now being equipped with a type of engine known as the tandem compound condensing engine. These engines effect quite a saving in fuel as well as giving surplus power when wanted. Three or four of the foremost engine builders along the Western rivers are now building this type of engine almost exclusively.

No detailed description of these engines is necessary, as they have been described and designs have been illustrated in this publication in previous issues.

Towboat Eugene Dana Smith

A good example of the small towboats recently built on the Western rivers is shown in Fig. 2. This boat is the *Eugene Dana Smith*, of 99 tons, equipped with three cylindrical two-flue boilers and two high-pressure non-condensing engines. The boilers are 40 inches diameter and 24 feet long, arranged in a single battery connected with steam and mud drums, each boiler having two 14-inch flues and allowed a working steam pressure of 198 pounds per square inch. The engines have cylinders 14 inches diameter and 72 inches stroke, with California cut-off valve gear and "inside" cam gear. This cam gear operates the valve gear without the use of cams on the stern-wheel shaft, the gear being attached to the "pitman," or engine driving rod. The stern-wheel is 15 feet 9 inches diameter, fitted with fourteen buckets, each 17 feet long and 30 inches wide. The average number of revolutions of the wheel is about 22 with a loaded tow and about 24 with an empty tow.

FIG. 8.—SMALL RIVER PACKET BOAT, A TYPE GENERALLY USED ON THE OHIO AND MISSISSIPPI RIVERS

The fuel consumption of the three boilers per twenty-four hours in up-stream work is about 600 bushels of 1-inch slack coal, which is equivalent to about 24 tons. With a full supply of coal, or enough for about a fifty-two hours' run, and with a complete outfit on board the steamer, the vessel draws about 48 inches of water. When the vessel is light with fuel for a six hours' run, but with most of the outfit still on board, the boat draws 36 inches of water.

The towing capacity of the boat, as it is commonly termed, is fourteen barges. These barges are of about 550 tons burden loaded. The up-stream capacity of the boat is about twelve empty barges and fuel flats, which is equivalent to about 1,400 tons. This capacity is rated against a river current of 4 miles per hour when the boat is making a speed of about 3 miles per hour.

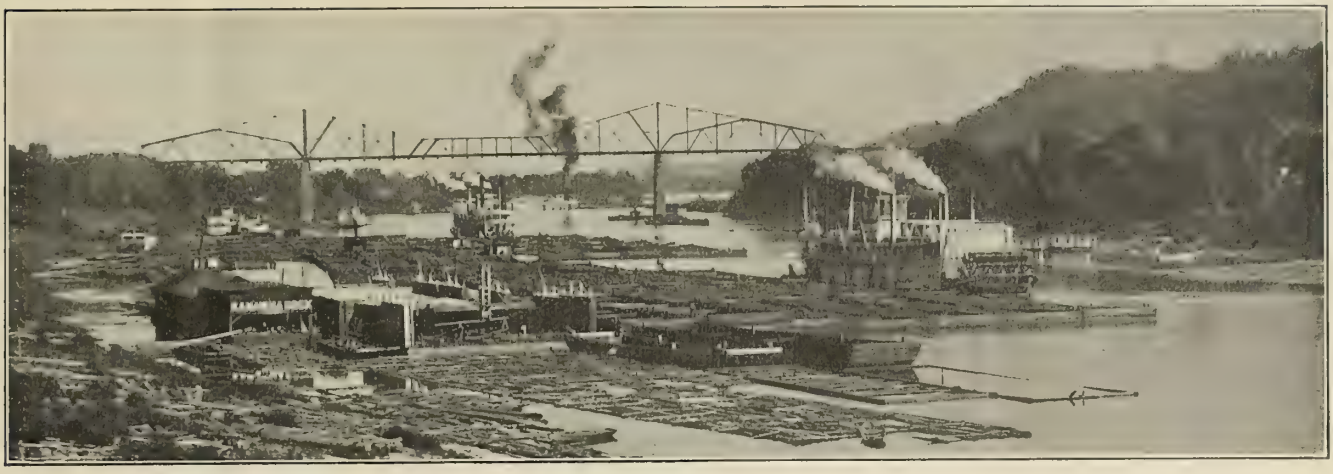


FIG. 9.—COAL HARBOR AT MOUTH OF KANAWHA RIVER, WEST VIRGINIA, WITH FLEET OF TOWBOATS PREPARING TO MOVE LOADED TOWS

The *Eugene Dana Smith* is 123 feet long as measured on the hull and 143 feet long over all, including the wheel. The beam is 27 feet and the depth 4 feet. She was built for special service in towing coal, and was especially strengthened for ice-breaking during the winter season. The hull is constructed of the best Kanawha white oak, all timber in the hull, except the decking, being saturated in salt brine for about two years. The timbers are fastened with galvanized spikes and bolts. The steamer is provided with electric lights and a searchlight, steam steering gear, etc., and responds very quickly to her helm.

The Iron Duke

Another vessel of interest, built for a special service, and known as a "tug pump boat," is the *Iron Duke*, a vessel 82 feet long, 14 feet wide and 4½ feet deep. The hull is built of Kanawha oak and is propelled by twin screws. The propellers are four-bladed, 58 inches diameter and 82 inches pitch. Owing to the shallowness of the hull and the draft, which is only 42 inches, the wheels are set so that the blades extend 9 inches below the bottom of the boat and 7 inches above the water.

The machinery consists of two sets of vertical fore-and-aft high-pressure engines, the cylinders of each engine being 9 by 12 inches. Complete with the thrust block each engine weighs 3,000 pounds. At normal speed the engines turn at about 240 revolutions per minute. Steam is supplied at 180 pounds pressure from a cylindrical two-flued boiler, 44 inches diameter and 22 feet long, with flues 16 inches diameter.

Both the boiler and engines are placed aft of the center of the boat owing to the installment of the pumping apparatus, which has a swinging boom supporting a suction pipe leading from a large duplex pump. The boom carries the suction pipe some 30 feet beyond the side of the steamer, and the boat was built for the special work of pumping and moving loaded and empty barges. She is capable of a speed of 10 miles an hour, and with her twin screws is a handy towboat, easily handling two barges of 550 tons capacity each. Fig. 3 shows the *Iron Duke* in use as a towboat, exchanging an empty barge for a loaded one at a coal tipple.

Sea-Going Motor Torpedo Boat.—Messrs. Yarrow & Company, Ltd., Scotstoun, Glasgow, built recently a 100-foot seagoing torpedo boat, or gunboat, propelled by internal combustion engines. The beam of the boat is 13 feet 6 inches, and in light trim she is capable of a speed of 23 knots. At cruising speed a radius of action of no less than 600 miles can be obtained. The boat can be armored with three 3-pounder guns or two 6-pounder guns or one torpedo tube, as occasion may require.

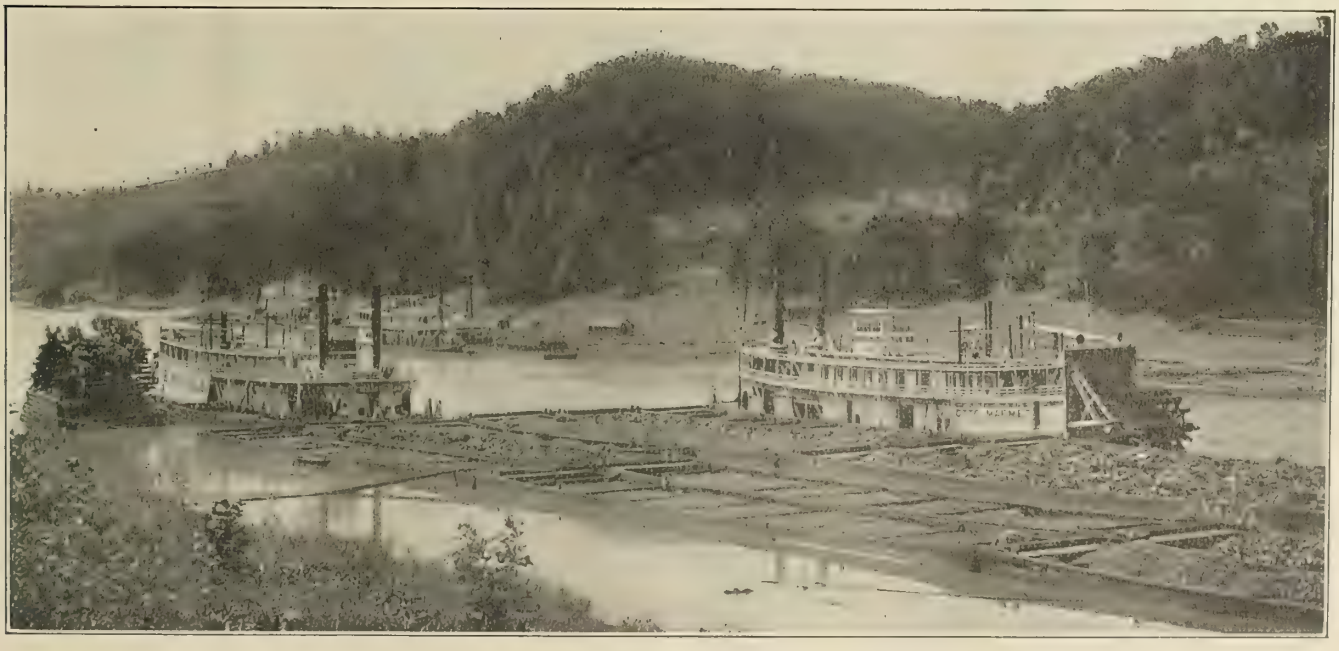


FIG. 10.—COAL LANDINGS ON KANAWHA RIVER WITH TOWBOATS AND FLEET OF BARGES

Modern German Stern-Wheel Steamers

BY E. VAN DER WERF

On the Elbe, Oder and Weichsel Rivers and their tributaries a large number of stern-wheel steamers are in service, most of which are used as tugs. The building of this type of vessel in Germany has now reached a high degree of efficiency, as can be seen from the plans of the steamer accompanying this article. The steamer illustrated, which is a representative stern-wheel type, has the following dimensions:

	Feet
Length over all	153.5
Beam, molded	19.0
Depth at side	6.3
Highest fixed point above light draft	9.8
Draft with 10 tons of coal	2.13

The hull is built of Siemens-Martin steel with angle-bar frames spaced 24 inches apart. Web frames are fitted where the size of the hold necessitates further stiffening. The thickness of plating and general construction can be seen from the drawings. The rudder is of the balanced type.

Vessels of this type are not built on an even keel, the bottom having a curvature according to the distribution of the different weights of the vessel, thus avoiding by the change of form an increase of draft in loaded condition.

Floors are arranged on alternate frames in the cargo spaces, while in the engine and boiler spaces the scantlings of the floors are increased, and they are fitted on every frame. One

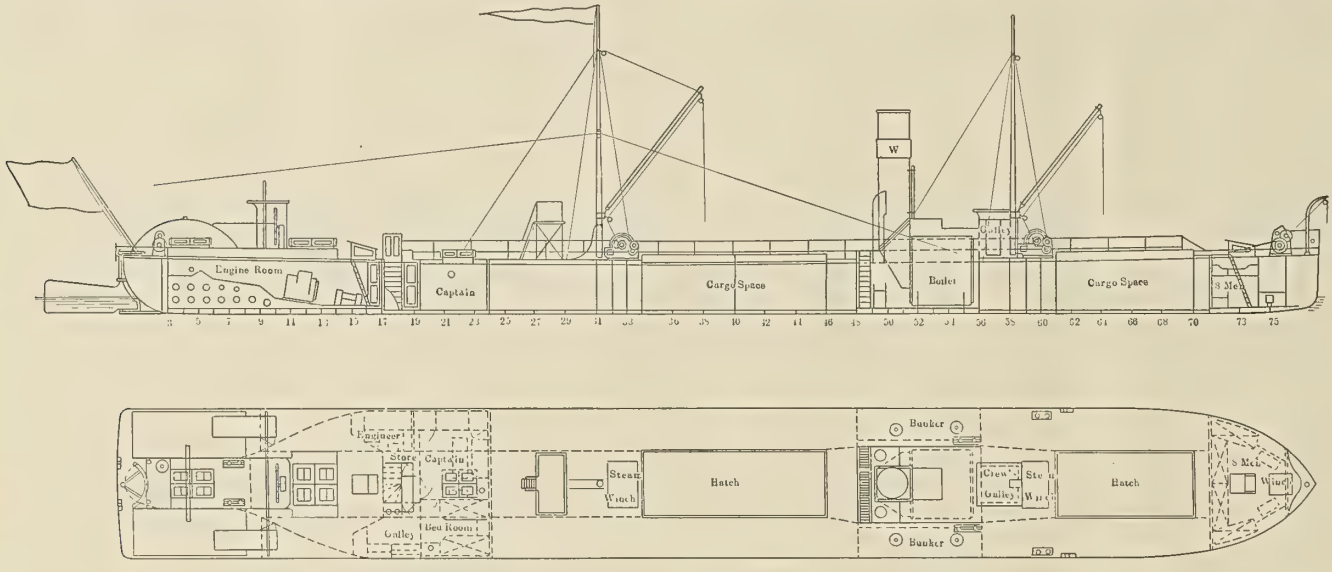


FIG. 1.—PROFILE AND DECK PLAN OF TYPICAL STERN-WHEEL STEAMER ON GERMAN RIVERS

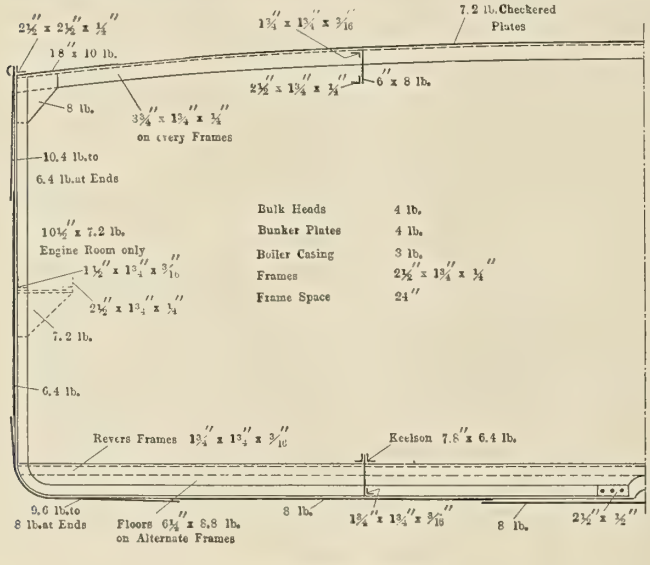

2½" x 2½" x ¼"
18" x 10 lb.
8 lb.
3¾" x 1¾" x ¼" on every Frames
10.4 lb. to 6.4 lb. at Ends
10½" x 7.2 lb. Engine Room only
1½" x 1¾" x 3/16"
2½" x 1¾" x ¼"
7.2 lb.
6.4 lb.
1¾" x 1¾" x 2/16"
7.2 lb. Checkered Plates
2½" x 1¾" x ¼" 6" x 8 lb.
Bulk Heads 4 lb.
Bunker Plates 4 lb.
Boiler Casing 3 lb.
Frames 2½" x 1¾" x ¼"
Frame Space 24"
Revers Frames 1¾" x 1¾" x 3/16"
Keelson 7.8" x 6.4 lb.
9.6 lb. to 8 lb. at Ends
Floors 6¼" x 8.8 lb. on Alternate Frames
8 lb.
1¾" x 1¾" x 3/16"
8 lb.
2½" x ½"

FIG. 2.—MIDSHIP SECTION

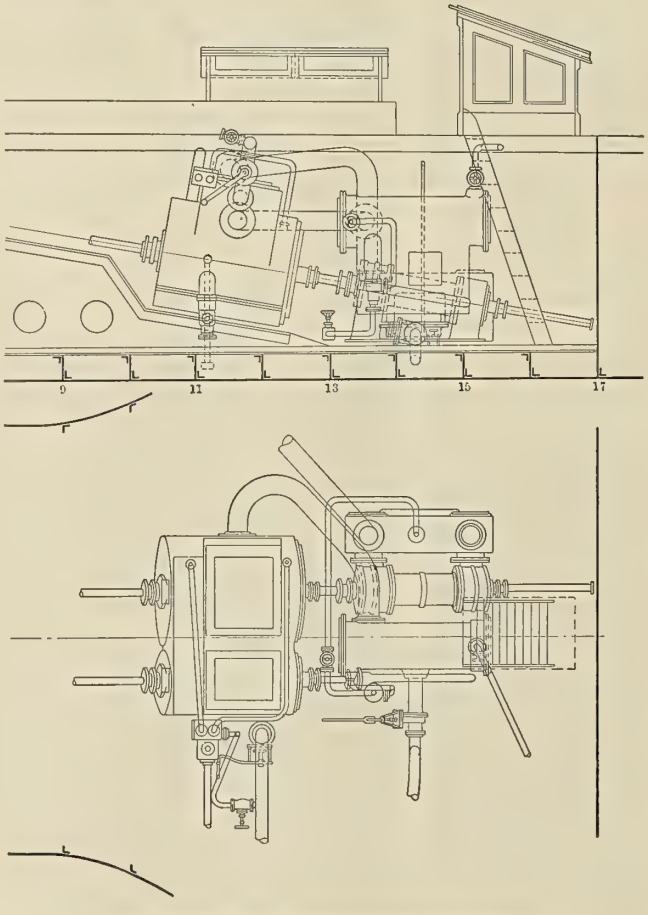


FIG. 3.—ELEVATION AND PLAN OF ENGINE ROOM

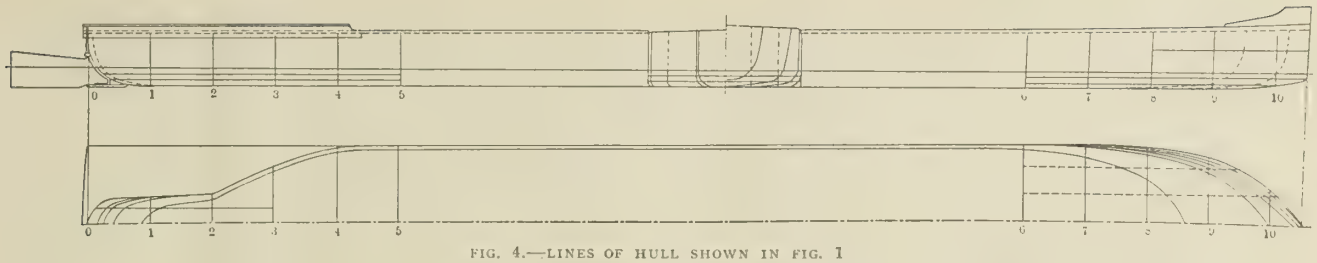


FIG. 4.—LINES OF HULL SHOWN IN FIG. 1

intercostal keelson is fitted on each side of the vessel, the scantling being increased in both the engine and boiler rooms.

The shape of the vessel at the stern is drawn in so as to leave room on each side for the double paddle-wheels, which are of the most approved design, with nine feathering curved iron paddles, about 5 feet in length and 2 feet wide. The use of feathering wheels and curved paddles has been found to give the best efficiency for this type of shallow draft vessel.

The hull is divided into seven compartments by six 'thwartship bulkheads; the extreme after compartment is reserved for stores, while the compartment forward of it is the engine room, having its entrance through a companionway on deck. The engine is of the inclined compound type, arranged as shown in Fig. 3, with cylinders 18.2 and 32 inches diameter and a stroke of 37.6 inches. The engine indicates about 225 horsepower.

The third compartment from the stern contains the living quarters for the captain and engineer as well as the galley and pantry. The entrance to this compartment is from the deck, while the engineer has a separate entrance to his room directly from the engine space.

The next compartment is reserved for cargo and the next beyond is taken up by the boiler and bunkers. The boiler is 7.8 feet long, 8.85 feet diameter, fitted with two furnaces and having a total heating surface of 936.5 square feet. The boiler is designed for a working pressure of 118 pounds per square inch.

The compartment forward of the boiler room is reserved for cargo, while the crew's quarters are arranged forward of the forward collision bulkhead.

The masts, booms and necessary gear for handling cargo are arranged as shown in the drawings. Besides carrying freight, the steamer is used also as a tug, the tow line running through an iron block attached to the after mast to bollards on either side of the boiler enclosures.

The weights of the vessel and her machinery are as follows:

	Tons
Plates (including rivets)	44.5
Angles (including rivets)	17.0
Forgings	4.0
Wood	13.0
Outfit	10.0
	88.5
Engine	18.0
Boiler	13.2
Water in boiler and pumps	6.5
Coal	12.0
	138.2
Displacement margin	6.6
	144.8

Another type of stern-wheel steamer is in service, principally on the Weser, in which the after part of the vessel is drawn together for a longer distance in order to allow for the arrangement of the engine and boiler in one compartment. With this arrangement no fireman is required, as the engineer can take charge of both the boiler and the engine. The centers of the wheels are located about 26 feet from the stern, and the normal shape of the hull is resumed at a point about 46 feet from the stern. Water tanks are provided in the forebody of the hull for trimming the vessel on an even keel when unloaded.

The dimensions of these vessels are:

	Feet
Length between perpendiculars	187.0
Beam, molded	25.6
Depth at sides	7.2
Draft with 250 tons of cargo	3.94

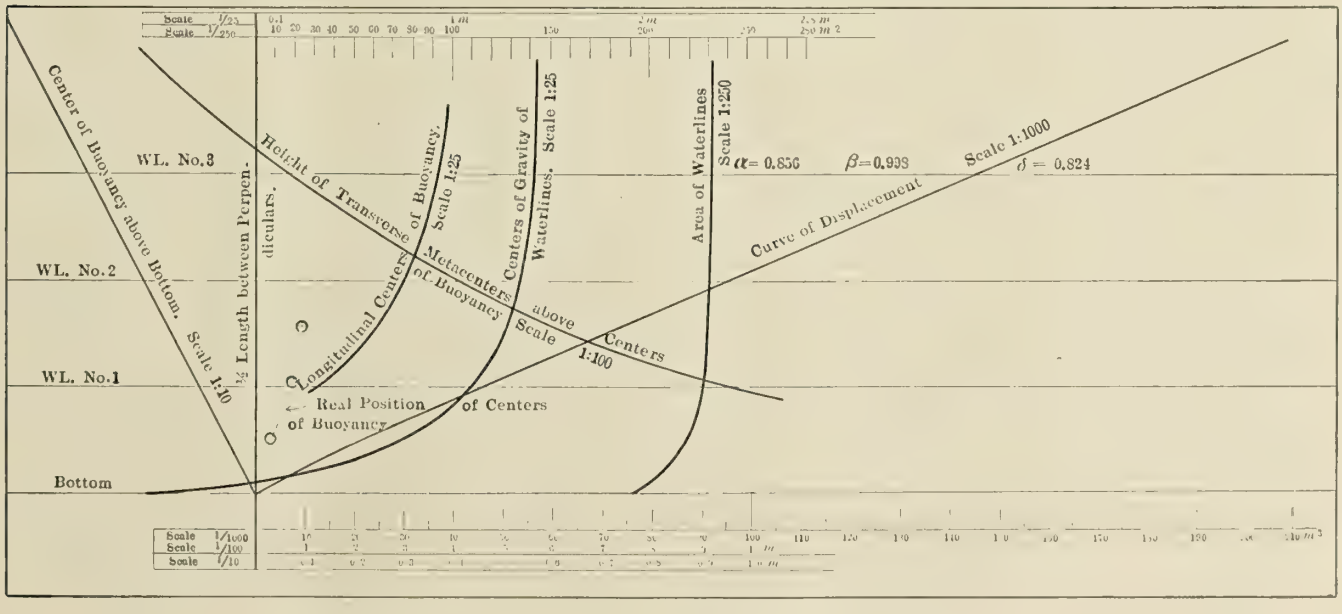

Center of Buoyancy above Bottom. Scale 1:40
WL. No.3
WL. No.2
WL. No.1
Bottom
½ Length between Perpendiculars.
Height of Transverse Metacenters above Centers of Buoyancy. Scale 1:25
Longitudinal Centers of Buoyancy. Scale 1:25
Centers of Gravity of Waterlines. Scale 1:25
Area of Waterlines Scale 1:250
α = 0.856
β = 0.938
δ = 0.824
Curve of Displacement Scale 1:1000
Real Position of Centers of Buoyancy
Scale 1:100

FIG. 5.—CONSTRUCTION DATA FROM THE DESIGN SHOWN IN FIGS. 1-4

The engines are of the compound type, with cylinders 14 inches and 26 inches diameter with a stroke of 40 inches, developing about 180 horsepower. The boilers are of the cylindrical type, about 100 inches diameter by 108 inches long, with a heating surface of 753.5 square feet. The wheels, fitted with nine paddles, are of the feathering type, as in the other vessels.

Shallow Draft Oil Steamer Comte de Flandre

One of the largest vessels ever built on the raised propeller system is the steamer *Comte de Flandre,* built by Messrs. Yarrow & Company, Ltd., Scotstoun, Glasgow, to the order of Messrs. Lever Bros., Ltd., of Port Sunlight. The vessel is designed to run on the Congo to bring oil from the upper reaches down the river, the designs and the work having been carried out under the supervision of Messrs. Esplen & Sons, of Liverpool. The length of the hull is 190 feet, the beam 30 feet and the molded depth 8 feet.

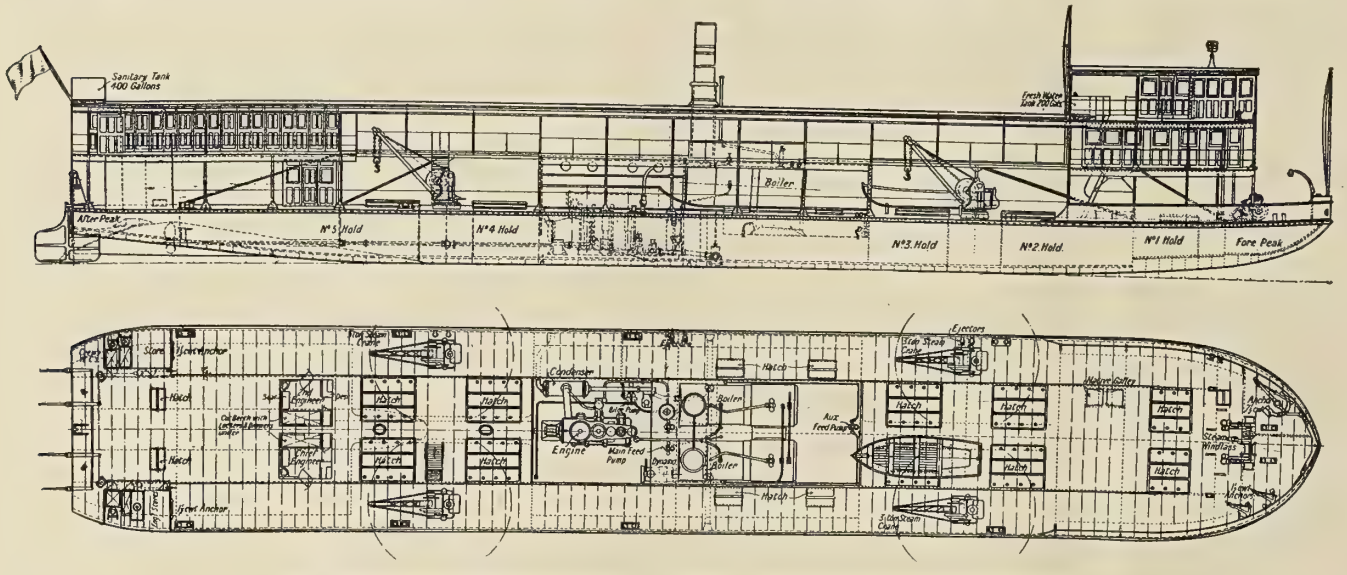
The raised propeller system, which has been incorporated in the design, is now so well known that an extended description is unnecessary. It is sufficient to refer to previous shallow draft numbers of this journal to obtain full particulars. Briefly, the raised propeller system consists of having the screw placed in an inverted tunnel, the after part of which is hinged so that the extreme after end of this hinged flap can impinge upon the water at whatever draft the boat may be loaded to, so that the action of the propeller in the tunnel will expel the air from the tunnel and enable the propeller to work in what is called "solid" water without causing undue resistance by the too deep immersion of the after end of the tunnel.

The hull of the *Comte de Flandre* is divided into ten compartments, the propelling machinery being placed amidships. Forward are three holds having a total capacity of 10,080 cubic feet, while aft are two holds with a total capacity of 11,950 cubic feet. Altogether the boat has a total deadweight cargo capacity of 250 tons. When fully loaded the draft of the vessel is only 4 feet 6 inches, at which the estimated speed is 10 knots.

Accommodation is provided for ten first class passengers on the spar deck aft. The dining room, with adjoining galley, is forward, above which are quarters for the captain and manager.

The propelling machinery consists of a single set of triple-expansion engines, built by Messrs. Yarrow. The high and intermediate-pressure cylinders are fitted with piston valves and the low-pressure cylinder with a flat double-ported slide valve. Steam is supplied by two locomotive type boilers, constructed by the North British Locomotive Company, of Glasgow. As wood is used for fuel these boilers are fitted with large tubes and specially large fireboxes.

The auxiliaries include an electric plant and a full equipment of pumping appliances. In addition to a steam winch for working the anchor and warping the ship around bends in the river, the deck machinery includes four 3-ton steam cranes for handling freight, each crane serving two holds.



OIL CARRIER COMTE DE FLANDRE, BUILT BY MESSRS. YARROW FOR SERVICE ON THE CONGO

Assessment of Panama Tolls by Net Tonnage Measurement an Injustice

It is not often that INTERNATIONAL MARINE ENGINEERING deviates from its text of engineering in the marine field, but the United States Government has so bungled the subject of tolls in the Panama Canal that we feel it a duty to protest. A thoroughly scientific manner of assessing tolls was presented to the Congressional committee having the subject in charge and also to the President of the United States, but for some reason unknown to the public the old unreliable method of basing tolls on net tonnage was adopted. Net tonnage means little, if anything, depending upon the man who uses it. It is like figures which cannot lie as much as the man who uses them. Net tonnage works an injustice to some people and gives other people more than they are entitled to, especially if they wish to be tricky. Instead of simplifying the assessing of tolls it complicates them. The policy adopted by the Government opens the door to fraud upon the Government and the ship owner. Instead of being honest and perfectly fair to both sides it deliberately drives shipbuilders and ship owners to subterfuge and petty trickery to get around the law. The action taken by the United States Government is a serious reflection upon American engineering ability and a great step backwards in these days of scientific attainments.

SHIPBUILDING RETURNS.—The Bureau of Navigation reports 101 sailing, steam and unrigged vessels of 30,854 gross tons built in the United States and officially numbered during the month of September. For the three months ending Sept. 30, 376 sailing, steam and unrigged vessels of 0,222 gross tons were built as compared with 485 vessels of 80,281 gross tons built during the same quarter a year ago. The increase this year is general throughout the country.

FIG. 1.—FIRST OF THE FIFTEEN PRODUCER GAS BARGES BUILT FOR THE ALABAMA-NEW ORLEANS TRANSPORTATION COMPANY

Shallow-Draft Producer Gas Motor Barges

Fifteen steel producer gas motor barges, designed to carry 1,000 tons cargo on a draft of 6 feet at a speed of 7 miles per hour, were ordered several months ago from the Great Lakes Engineering Works, Detroit, Mich., by the Alabama-New Orleans Transportation Company for service between the Black Warrior Coal Basin in Alabama and New Orleans. The waterway on which these barges will ply covers a total distance of about 515 miles through the Black Warrior, Tombigbee and Mobile Rivers, the Mississippi Sound and the Lake Borgne Canal. The mines in the Black Warrior Basin produce about 6,000,000 tons of coal per year, all of which up to the present time has been carried by rail to New Orleans at a cost, including switching and terminal charges, of about $1.30 (5/5) per ton. Transportation of this coal by water, it is estimated, can be accomplished at a rate of $1.20 (5/0) per ton with a fair profit. The barges will be used exclusively for carrying coal from the Black Warrior mines to New Orleans, the return cargoes consisting of scrap iron and Cuban ores.

A shipyard for the construction of the barges was erected on Lake Borgne Canal about 10 miles north of New Orleans. Three of the barges were launched early in the summer and one was completed and placed in commission in July. After a thorough trial of the first barge work on the remaining vessels has been pushed forward rapidly so that one barge could be delivered every four weeks.

The barges are 240 feet long, 32 feet beam and 8 feet deep. They are built of steel throughout with one bulkhead aft of the forecastle and one forward of the engine room. The propelling machinery is placed in the stern, and the deck is free of hatches, as the barges are designed to carry the entire load on the deck. The crew is berthed in the forecastle, while the galley and pilot-house are placed aft over the machinery space.

Propulsion is by two three-cylinder special marine gas engines of 75-brake horsepower each, driving right and left-hand propeller wheels made of semi-steel 46 inches diameter, 2 feet 9 inches pitch, with a developed area of blades of 6.67 square feet. The engines are designed to develop their estimated power at a normal speed of 300 revolutions per minute.

The fuel is producer gas made from "coke breeze" in a

FIG. 2.—PRODUCER GAS BARGE UNLOADING AT NEW ORLEANS

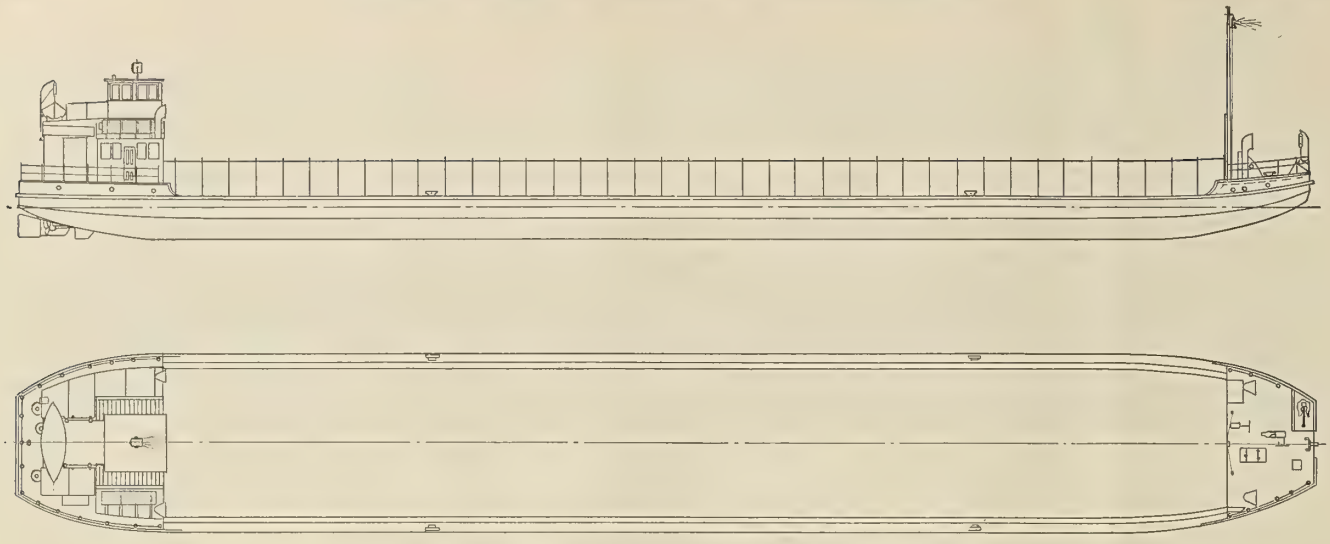


FIG. 3.—GENERAL ARRANGEMENT PLANS OF PRODUCER GAS BARGE

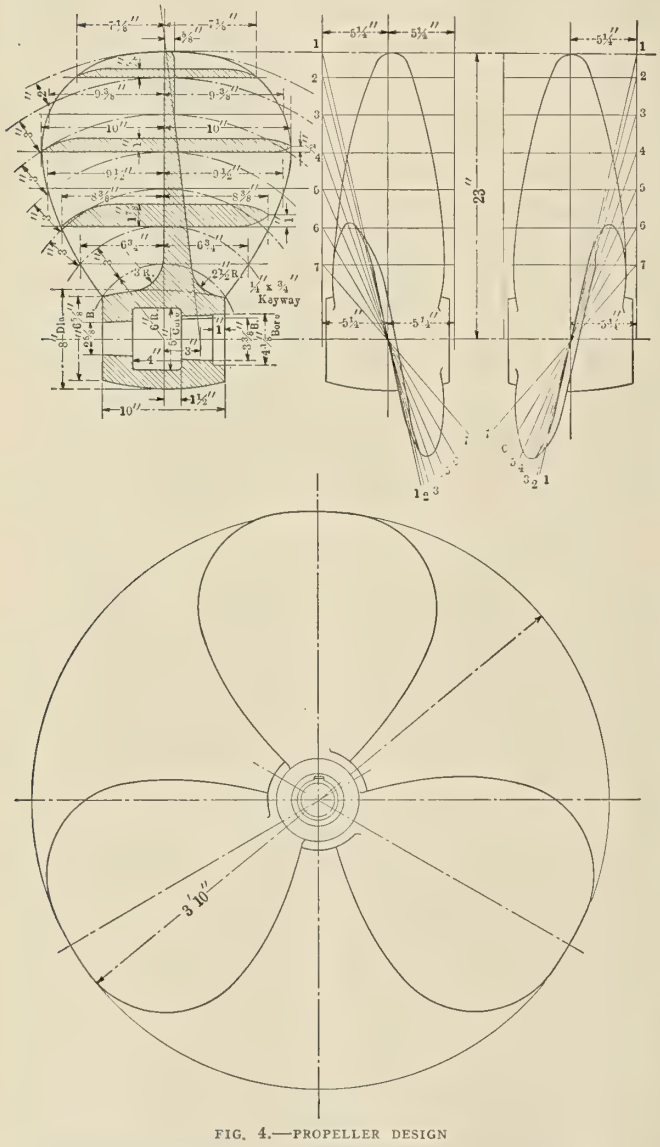


FIG. 4.—PROPELLER DESIGN

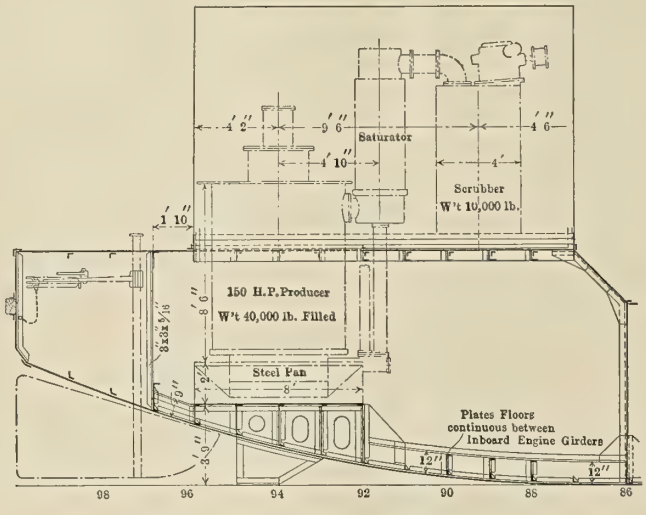


FIG. 5.—ARRANGEMENT OF GAS PRODUCER

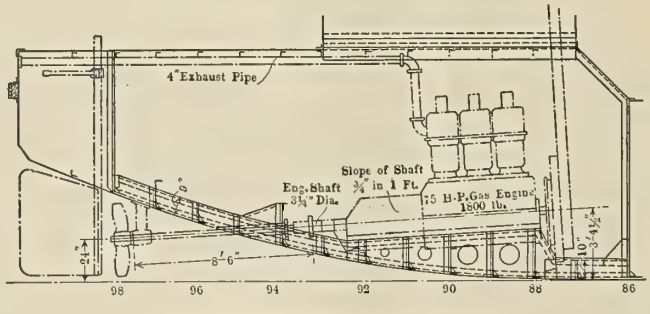


FIG. 6.—SECTION SHOWING PORT ENGINE

single producer, with the usual equipment of saturator, scrubber and tar extractor. "Coke breeze" is the waste coke from the coke oven, consisting of fine, small particles of coke which cannot ordinarily be used in commercial practice, but which it is found makes a splendid fuel for a gas producer. The total cost of fuel to supply the engines with gas averages about $2 (8/4) per twenty-four hours.

The arrangement of the gas producer and its accessories, together with the main and auxiliary engines, can be seen from the sections shown in Figs. 5, 6 and 7. One of the main engines is connected by friction wheels to a 5-inch ballast pump, while the other engine is arranged to drive in a similar manner a small electric generator. An auxiliary gasolene (petrol) engine is provided to furnish power for the electric generator when the vessel is in port. There is also a small air compressor for supplying the necessary air for starting the main engines. The windlass, forward, is driven by electricity, and the barge is steered by hand.

The steering of the barges, it is claimed, is a very easy task. The vessel responds to the wheel as readily as a yacht, and is under complete control every moment, in spite of the unusual proportions of the hull and the novel arrangement of the machinery.

The successful solution of the problem of constructing a self-propelled barge equipped with gas engines operating on producer gas generated from the cheapest kind of fuel obtainable is worthy of note. On trial the first barge completed made an average of 8½ miles per hour loaded, although the guaranteed working speed while carrying 1,000 tons on a 6-foot draft was only 7 miles per hour. The maximum speed attained on trial was 8.9 miles per hour, the conditions as to wind, etc., being normal.

In order to determine in advance the success of the gas producer and gas engine outfit as applied to marine work, exhaustive experiments were carried out by the builders prior to the installation of the gas producer equipment in the boat. The design of the propeller wheels was investigated very thoroughly, as it was realized that the general dimensions, pitch, blade area and shape of the blades would have a very important bearing upon the success of the propelling machinery. The details of the design adopted are shown in Fig. 4, one of the wheels being right-hand and the other left-hand.

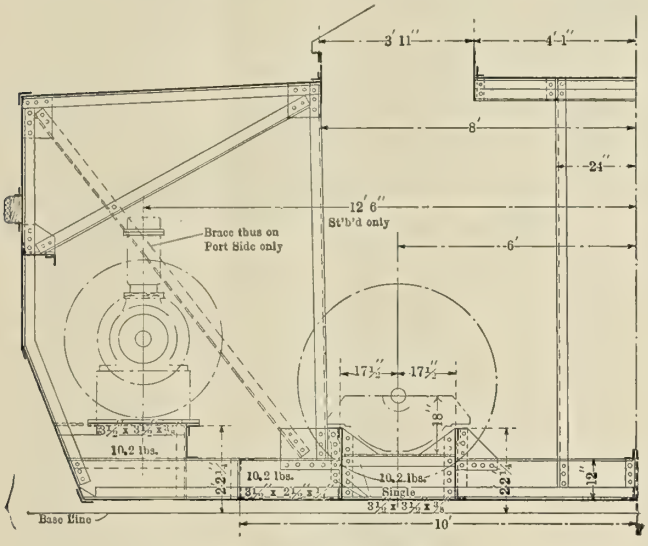


FIG. 7.—SECTION AT FRAME 90

In making the propellers, special attention was given to obtaining the true pitch and a perfectly balanced wheel when running. When it is considered that the extreme diameter of these wheels is 46 inches, and that they are run at a speed of 300 revolutions per minute in a very light craft, the accuracy sought in the design and construction of the propellers will be fully appreciated as being of paramount importance, and it is pleasing to learn that the results with these wheels have been satisfactory in every respect.

International Conference on Safety at Sea.—The United States will be represented at the International Conference on Safety at Sea in London on Nov. 12 by the following delegates: Representative J. W. Alexander of Missouri, chairman of the Committee on Merchant Marine; Senators Fletcher of Florida and Burton of Ohio; E. T. Chamberlain, Commissioner of Navigation; Commandant E. P. Bertholf, Revenue Cutter Service; Rear Admiral Washington L. Capps, formerly Chief Constructor of the United States Navy; Capt. George F. Cooper, hydrographer of the navy; Capt. W. H. G. Bullard, superintendent Naval Radio Service; Homer L. Ferguson, general manager Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; Albert Gilbert Smith, vice-president of the New York & Cuba Steamship Company; Andrew Furuseth, head of the Seamen's Union, and George Uhler, Supervising Inspector-General of the Steamboat Inspection Service.

Motor Gunboats for Colombia

Three motor gunboats, driven by gasolene (petrol) engines of the Yarrow-Napier type, have recently been built by Messrs. Yarrow & Company, Ltd., Scotstoun, Glasgow, for the Colombian Government, to be used for coastal defense. These boats are of considerable interest just now, not only on account of the fact that they are among the first motor gunboats ever put in commission for coastal defense duties, but also on account of the fact that the British Admiralty is seriously considering the question of employing yachts fitted with light armament as an auxiliary to the navy.

These boats were erected and bolted together in Yarrow's shipyard, and then taken to pieces and sent out in knock-down form, two to Cartagena and one to Buenaventura. The first boat shipped to Cartagena is now running very successfully; the second one at the time of writing is on the point of being launched, and the third one, at Buenaventura, is being reconstructed at that port. The main dimensions are: 80 feet length between perpendiculars, 12 feet 6 inches molded breadth, and 5 feet 8 inches molded depth.

MOTOR GUNBOAT FOR COLOMBIAN COASTAL DEFENSE

The main propelling machinery in these boats consists of two Yarrow-Napier four-cycle gasolene (petrol) engines, each of about 60 horsepower, of the four-cylinder type similar to those fitted in the *Yarrow-Napier,* which was built some years ago for the British Admiralty by Messrs. Yarrow. For small vessels, and particularly for government duties, where expensive fuel is not a very important consideration, these engines have certain advantages over other types. The draft of the vessels is under 3 feet 6 inches, and they are fitted with keels of the flat plate type in order to enable them to run in shallow water. The starboard engine only is fitted with reversing gear, as this is considered quite sufficient for maneuvering purposes, and, furthermore, simplifies the machinery. The fuel is carried in two tanks, 8 feet 6 inches long and 4 feet 6 inches diameter, of 900 gallons capacity each, which gives a radius of action at 12 knots of about 2,400 nautical miles.

The armament consists of a single quick-firing gun of 47 millimeters bore mounted on the forward deck. This is considered sufficient for the purposes for which the boats are required, as they are not expected to take any part in resisting a formidable attack but only to be capable of resisting landing parties or pirates. They are also to be used for custom house purposes to prevent smuggling. Each boat is fitted with a powerful searchlight for the purpose of detecting any landing parties in the creeks which abound on the coast.

Side Wheel Ferry Leschi

A new steel side-wheel ferry is now being completed by Messrs. J. F. Duthie & Company, of Seattle, Wash., for the port of Seattle. The vessel is for use on Lake Washington, and will accommodate the rapidly-increasing traffic between the city and the districts across the lake, a distance of about 3 miles.

The designs were prepared by Mr. Fred A. Ballin, of Portland, Ore., and the construction is under the supervision of Mr. L. E. Geary, of Seattle. The contract price was $85,000 (£17,400).

The principal dimensions of the boat are as follows:

Length over all	169 feet
Length between perpendiculars	152 feet
Breadth, molded	33 feet
Breadth over guards	52 feet 4 inches
Depth, molded	8 feet 9 inches
Draft, fully equipped	4 feet 9 inches

The hull to the main deck is built of mild steel, and is divided transversely by three watertight bulkheads and one partial bulkhead, forming the fuel oil bunker. The hull is strengthened longitudinally by keelsons and stringers and by a pair of trusses extending from end to end. The engine and boiler seatings are strongly built up, and so designed that the strains are distributed over a long section of the bottom. The wheel and guard beams are of steel, and the superstructure is of wood as well as the main deck beams which support the roadbed for vehicular traffic.

The ferry is double-ended, with balanced rudders at each end controlled from two pilot houses. The main deck is chiefly given up to vehicles, of which forty or more can be accommodated. At the sides are toilets and smoking rooms, while the machinery space separates the two roadbeds, which are paved with asphaltum and have 12 feet clear headroom. The main cabin is situated on the upper deck, and is fitted with stationary settees to accommodate 300 passengers.

The machinery consists of a pair of high-pressure inclined engines, the cylinders of which are 16 inches diameter, with a stroke of 72 inches, designed to work at 40 revolutions per minute. The main shafts are 9 inches diameter, and drive feathering paddle-wheels measuring 15 feet over the buckets. The designed power of 700 indicated horsepower is expected to give a speed of 14 miles.

Steam is supplied by a Ballin watertube boiler of 4,000 square feet heating surface, working at 250 pounds per square inch with oil for fuel. In addition to this a large vertical donkey boiler is placed on the main deck. The exhaust steam from the engines may be either led to the smokestack or condensed in a specially designed exhaust ejector.

The auxiliary machinery consists of outside-packed, pot-valve Burnham feed pumps, a bilge and fire pump, sanitary pump, etc. The ferry is lighted by electricity throughout, current being furnished by a 7½-kilowatt Terry turbine set and a 2-kilowatt set of the same make for day lighting. Searchlights are placed on the top of each pilot-house. Steering wheels in each pilot-house connect with a Hyde steam steering gear in the engine room, arranged to work either rudder. The steam gear can be converted into a hand gear from each pilot-house in case of accident.

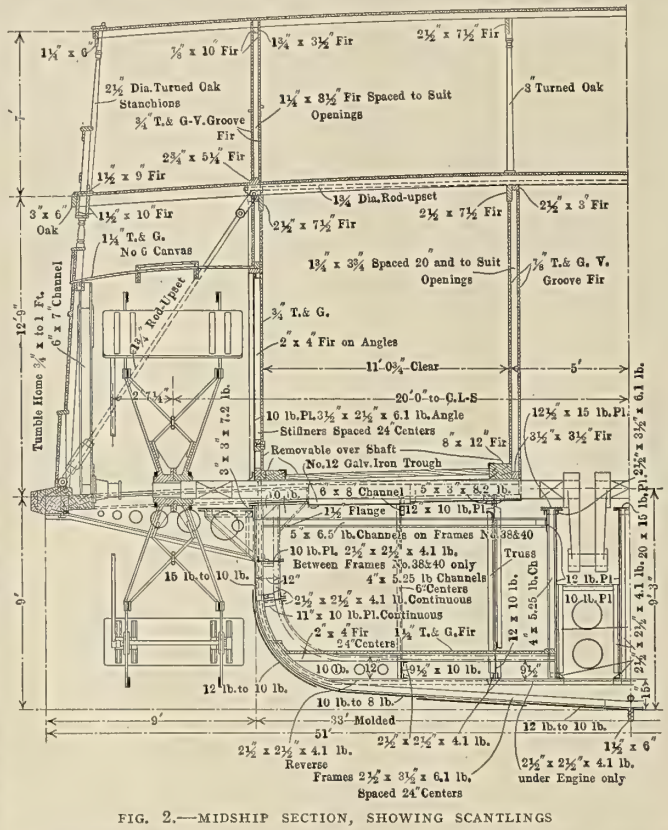

1½" x 6"
⅞" x 10" Fir
1¾" x 3½" Fir
2½" x 7½" Fir
2½" Dia. Turned Oak Stanchions
¾" T.& G-V. Groove Fir
1¼" x 8½" Fir Spaced to Suit Openings
8" Turned Oak
2¾" x 5¼" Fir
1½" x 9" Fir
3" x 6" Oak
1½" x 10" Fir
1¼" T.& G. No 6 Canvas
1¾" Dia. Rod-upset
2½" x 7½" Fir
2½" x 8" Fir
1¾" x 3⅜" Spaced 20" and to Suit Openings
⅞" T.& G. V. Groove Fir
6" x 7" Channel Tumble Home ¾" to 1 Ft.
¾" T.& G.
2" x 4" Fir on Angles
11'-0¾"-Clear
5'
20'-0"-to-C.L-S
10 lb. Pl. 3½" x 2½" x 6.1 lb. Angle Stiffners Spaced 24" Centers
12½" x 15 lb. Pl.
3½" x 3½" Fir
8" x 12" Fir
Removable over Shaft No. 12 Galv. Iron Trough
6" x 8" Channel
9" x 3" x 8.2 lb.
1½" Flange
12" x 10 lb. Pl.
5" x 6.5 lb. Channels on Frames No. 38&40
10 lb. Pl. 2½" x 2½" x 4.1 lb. Between Frames No. 38&40 only
Truss
15 lb. to 10 lb.
12"
4" x 5.25 lb Channels 6" Centers
2½" x 2½" x 4.1 lb. Continuous
11" x 10 lb. Pl. Continuous
2" x 4" Fir 24" Centers
1½" T.& G. Fir
12 lb. to 10 lb.
10 lb. to 8 lb.
33'-Molded
51'
2½" x 2½" x 4.1 lb. Reverse
2½" x 2½" x 4.1 lb.
1½" x 6"
2½" x 2½" x 4.1 lb. under Engine only
Frames 2½" x 3½" x 6.1 lb. Spaced 24" Centers

FIG. 2.—MIDSHIP SECTION, SHOWING SCANTLINGS

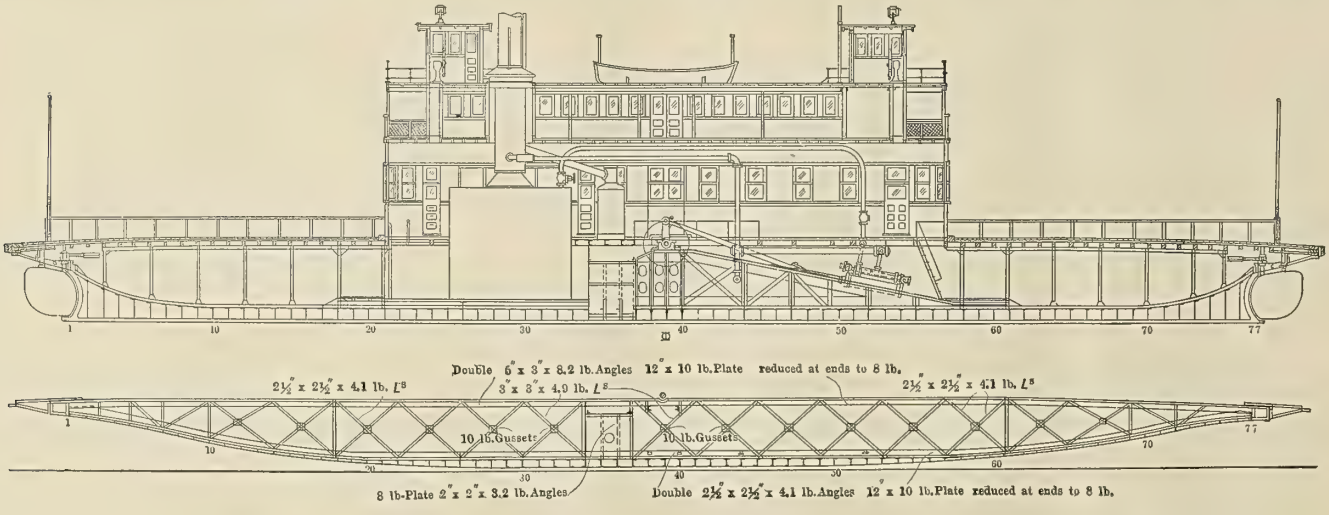

Double 6" x 3" x 8.2 lb. Angles
12" x 10 lb. Plate reduced at ends to 8 lb.
2½" x 2½" x 4.1 lb.
3" x 3" x 4.9 lb.
10 lb. Gussets
8 lb. Plate 2" x 2" x 3.2 lb. Angles
Double 2½" x 2½" x 4.1 lb. Angles
12" x 10 lb. Plate reduced at ends to 8 lb.

FIG. 1.—INBOARD PROFILE AND SECTION THROUGH LONGITUDINAL TRUSS OF LAKE WASHINGTON FERRY

The hull of the *Leschi* was completed in the yards of Messrs. J. F. Duthie & Company within two months after receipt of the material from the East. All the steel work was riveted in suitable sections, then knocked down and sent across to Lake Washington by car, where it was re-erected and the riveting completed.

Armored River Monitors for Brazil

BY F. C. COLEMAN

Three armored monitors, the *Javary, Solimoes* and *Madeira* are being built by Messrs. Vickers, Ltd., at the Naval Construction Works, Barrow-in-Furness, for the Brazilian Government. These vessels, the first of which, the *Javary,* was launched on June 17, have each the following dimensions: Length, 265 feet; breadth, 49 feet; depth, 8 feet 6 inches; mean draft, 4 feet 6 inches, with a displacement of 1,250 tons. The vessels were designed for a speed of 11½ knots and will have a radius of action at an economical speed of 4,000 nautical miles.

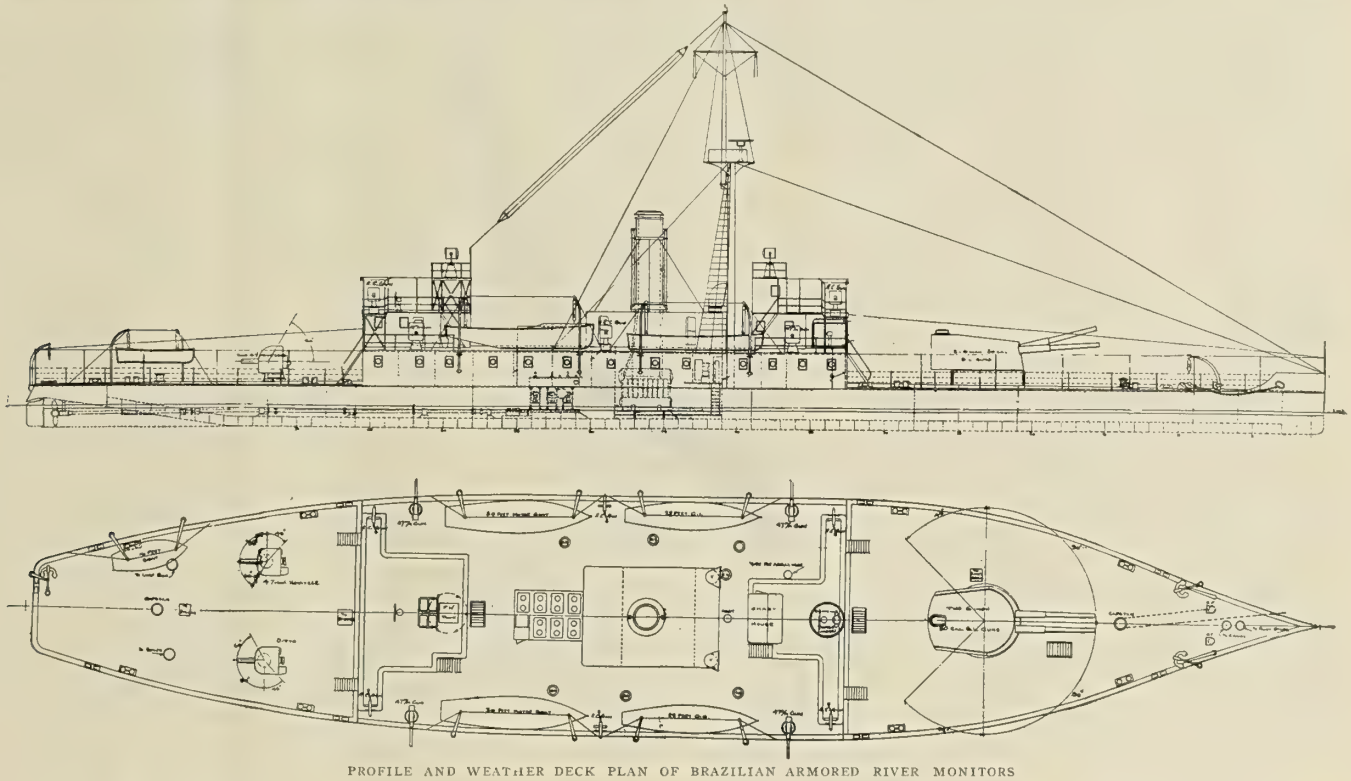
Primarily intended for river work, the vessels are each fitted with a double bottom extending almost the entire length of the ship, stowage being provided between the double bottoms for feed water, oil fuel for the boilers, etc. This double bottom construction is continued up the sides of the ship to the upper deck in way of the engine and boiler spaces and magazine, adding to the safety of the ship. The hull is also separated into a large number of watertight compartments by transverse and longitudinal bulkheads extending up to a complete steel upper deck. These compartments form the various store rooms, magazines, bunkers, auxiliary machinery spaces, etc.

The armament, which is of the Vickers type, consists of two quick-firing guns mounted in one armored turret on the upper deck forward and with electrical machinery for working the guns; two 4.7-inch howitzers on the upper deck aft; four 47 mm. quick-firing guns on the boat deck; and six R. C. guns on the boat deck and on the forward and navigating bridges. Suitable fire control arrangements for the guns are provided. Two powerful searchlight projectors are fitted, one forward and one aft, and these are arranged to be controlled from a suitable position on the forward navigating bridge.

The sides of the vessel amidships for a very considerable part of the length of the hull are armored by heavy plating of the latest type, extending from the upper deck to well below the waterline. Forward and aft of this belt are armored bulkheads, extending the same distance below the waterline as the side armor. The remaining portions of the vessel's sides, including the stern, are protected by thinner armor. The upper deck is of nickel steel armor forming protection to the various compartments. In the heavily armored conning tower are all appliances for working the guns, etc., and for controlling the vessel, and all communication wires, steering rods, etc., are placed within an armored communication tube.

The propelling machinery consists of two sets of vertical inverted direct-acting triple expansion engines, each set being complete with its own independent and separate surface condenser. Each set of engines has three cylinders working on separate cranks, placed at angles of 120 degrees with each other, and particular care has been taken in the design of the machinery for the balance of the various reciprocating parts.

The engines are designed to run at about 250 revolutions per minute with a working pressure of 250 pounds per square inch at the boilers, and 230 pounds per square inch at the engines. The diameter of the high-pressure cylinder is 11½ inches, the intermediate-pressure 18 inches and the low-pressure 18½ inches, the length of the stroke being 17 inches in each case.



PROFILE AND WEATHER DECK PLAN OF BRAZILIAN ARMORED RIVER MONITORS

The cylinders are of strong cast iron bolted together and forming a steam joint for the receivers, and are supported at the back and front on turned steel columns. The distribution valves are of the piston type for the high-pressure and intermediate-pressure cylinders and of the flat, double ported form for the low-pressure cylinders, separate liners being fitted for the high-pressure and intermediate-pressure valves and a loose face for the low-pressure valve, which is also fitted with a balance piston. All of the valves are actuated by double eccentrics and link motion, and are fitted with steam reversing gear of the "all round" type in addition to the usual hand gear.

The two condensers are arranged in the wings of the ship; they are cylindrical in form with the casings built up of steel plates and angles with gun metal waterway and cast iron doors. The circulating water is supplied by two pumps of the centrifugal type driven by independent single-cylinder engines of the enclosed forced lubrication type. The main

air pumps are independent and of the monotype pattern, one for each condenser.

The shafting is of mild steel throughout. The propellers are four-bladed, of bronze, the bosses and blades being cast solid. The propellers, which are arranged to turn outwards when going ahead, work in a tunnel in order to secure complete immersion under the light draft conditions.

Steam is to be supplied by two watertube boilers of the Yarrow type, and arranged for burning oil fuel in conjunction with coal. The feed water is supplied to the boilers by one main and one auxiliary feed pump of the direct-acting type and grease filters of the pressure type are fitted between the pumps and the boilers.

Distilling and evaporating machinery is supplied, and an oil fuel pump and air compressor are fitted in the boiler room in connection with the oil fuel system. There is a fire and bilge pump in the engine room. The See's ash ejector is supplied with a separate pump, which is also adapted for bilge purposes. A separate ash tube is fitted with hand hoisting gear for emergency use.

The magazines are ventilated and cooled on the thermotank system. An ice-making plant is also provided, and for the cold storage of meat and perishable goods there is an insulated compartment fitted with brine grids.

A boat deck is built above the upper deck, forming a superstructure in which the officers are accommodated. Pantries and lavatories are also built within this superstructure. On the boat deck accommodation is provided in steel deck houses for the commander and navigating officer. The commander's apartments include a commodious reception room and are handsomely decorated throughout. Messing and sleeping accommodation for the crew, including sick bay, dispensary, cockpit and operating room, are arranged in the forward part of the vessel below the upper deck. Sleeping accommodation is also arranged on the upper deck for troops. The complement is expected to be 100 officers and men.

Special attention has been given to both the natural and artificial ventilation of the vessel to give abundant supply of fresh air, in view of the extremely warm climate and great humidity of the atmosphere in the district in which the ship has to serve. The mechanical ventilation is carried out by means of ventilating fans worked by electric motors and all habitable and semi-habitable spaces, such as the various storerooms, etc., are provided with a very active circulation of air. The whole of the living quarters, including even those situated above the upper deck, are provided with electric ventilators so as to maintain an efficient circulation of air.

The electric power is derived from two sets of electric generators, one of which is driven by steam engines and the other by kerosene (paraffin) motors, the latter being capable of the full duty required when the boilers are not under steam. An installation of electric lighting is fitted throughout, and auxiliary lighting is provided for places where it is entirely indispensable, notably for ship's lights, lanterns, etc.

Steam steering gear of the latest pattern for the twin rudders is installed under the upper deck, capable of being actuated from the navigating bridge and conning tower. A steering wheel for emergency and steering is also provided.

FIG. 1.—ENGINES FOR THE RIVER STEAMER ALASKA PARTIALLY ASSEMBLED IN THE BUILDERS' SHOPS

A steam capstan is fitted forward, and for mooring operations and assistance in the work of turning the vessel round a capstan driven by kerosene (paraffin) engine is placed aft.

The vessel will have one mast and one funnel. The mast is fitted up with rangefinder platform and is made suitable for taking a wireless telegraph installation. Two navigating bridges extending the full breadth of the boat deck are fitted, with a commodious chart house of steel on the forward bridge.

Yukon River Boat Alaska

Navigation on the Yukon River is limited to only a few months each year, and this fact, coupled with the length of the waterway, makes it desirable to use comparatively high-speed boats in this service, so that as much freight as possible can be transported when the river is open to navigation.

The first vessel of the past season to reach Fairbanks from Whitehorse, a distance of over a thousand miles from the mouth of the Yukon River, was the Seattle-built steamboat *Alaska,* making the trip in five days and twenty-one hours. The White Pass & Yukon Railroad, owners of the vessel, constructed last winter two new river steamers in Seattle,

which were shipped north in knocked-down form and erected at Whitehorse, where they were launched at the opening of navigation on the river.

One of these boats, the *Alaska,* is 160 feet long and 32 feet beam, provided with ample accommodations for passengers as well as for freight. Propulsion is by a stern wheel, driven by engines 16 inches diameter by 72 inches stroke, fitted with

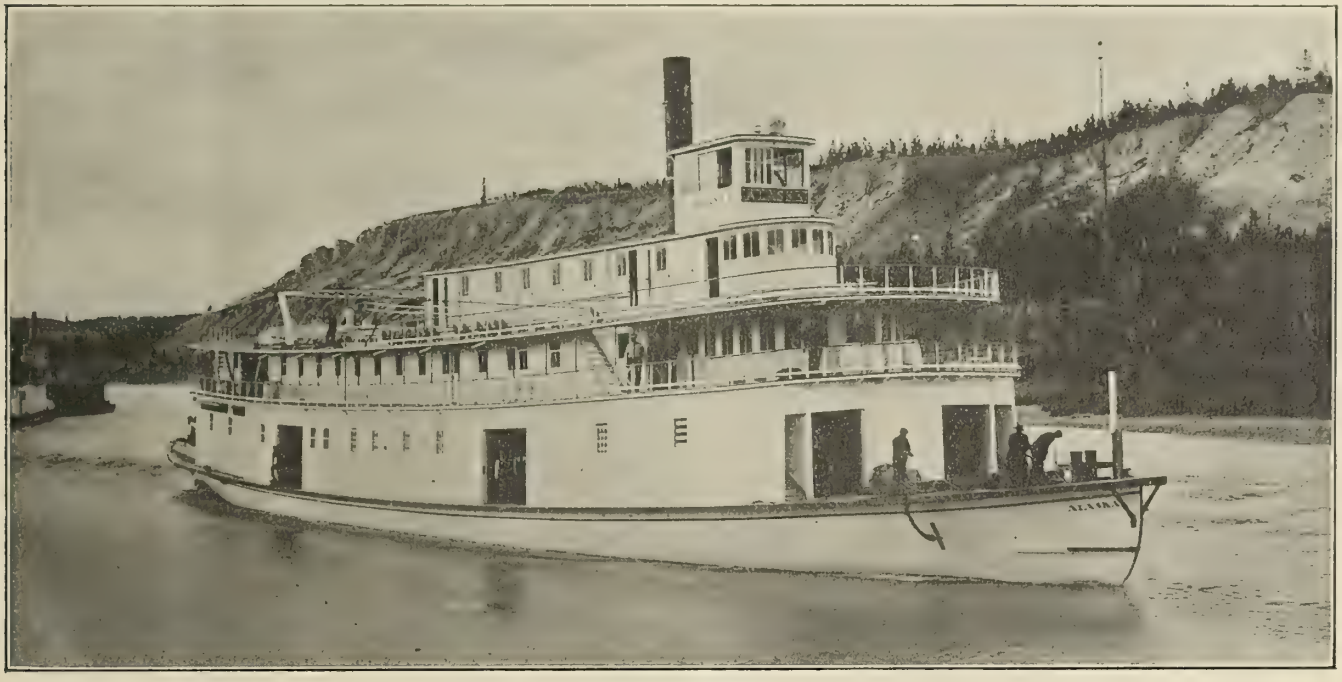


FIG. 2.—THE ALASKA

piston valves, Meyers' cut-off valves and double-bar links. The engines were built by the Seattle Machine Works, Seattle, Wash., the various parts of the engines being shipped as quickly as they were finished without being assembled in the builders' shops. The wheel shaft is 11 inches by 26 feet long, fitted with four 48-inch cast steel flanges and open-hearth forged steel cranks and pins. The pillar blocks are of cast steel. The main steam pipe is 6 inches diameter, extra heavy, with cast steel flanges shrunk on and riveted. The main exhaust pipe is 10 inches diameter, of light tubing with cast steel flanges riveted on. A slide throttle valve is fitted, balanced with a small auxiliary valve on top of the main valve.

Steam is supplied at a working pressure of 200 pounds per square inch from a locomotive firebox type boiler built by the Commercial Boiler Works, Seattle, Wash. The shell of the boiler is 63 inches inside diameter and 25 feet long over the smokebox. The firebox is 7 feet long, with a height of 6 feet 8 inches, and there are 222 2-inch outside diameter tubes, 14 feet long, making a total heating surface of 1,800 square feet. As wood is used for fuel on the boat, the grate surface is reduced to 15 square feet, the grate measuring 3 feet by 5 feet. The rest of the firebox is blanked off with dead plates. A horizontal steam drum, 30 inches diameter and 6 feet long, is fitted on top of the boiler, and connected to the shell with a 12-inch nozzle. The smokebox is 3 feet 7 inches deep, and is fitted with a wire spark arrester of four mesh. The products of combustion are carried off by a 30-inch smokestack extending to a height of 40 feet above the grate bars.

Placing fast steamers, such as the *Alaska,* in service between Whitehorse and Fairbanks on the Yukon River shortens the time for transportation between Puget Sound and Fairbanks by from ten days to two weeks as compared with previous service, and cannot fail to increase the trade of Puget Sound country with Alaska.

A Shallow Draft Tug Fitted with Six Propellers

BY F. MULLER VAN BRAKEL

In an article describing a single screw river tug published in the November, 1911, issue of INTERNATIONAL MARINE ENGINEERING, it was pointed out that the tugboats plying on the Rhine may be divided into two classes. The small single screw tugs up to 600 indicated horsepower bring lighters from Rotterdam to Duisburg and back, while farther up the river to Mannheim or even Strassburg the towing is done

FIG. 3.—DINING SALOON

mainly by big side wheelers of 1,000-1,500 indicated horsepower.

Last year a new type of tug was built in which are combined the advantages of both screw and paddle tugs. By arranging from 4 to 6 propellers on two lines of shafting, it was found possible to build a screw tug of 1,400 indicated horsepower on a 6-foot draft.

The boat, designed and constructed by Messrs. N. V. Scheepswerfvan P. Smit, Jr., of Rotterdam, for the well-

known firm of Math. Stiunes, of Mülheim, has the following dimensions: Length, 156 feet; beam, 27 feet 6 inches; depth, 10 feet. The hull, which is built of steel, is divided into seven compartments—i. e., fore peak, cabin, boiler room, cross-bunker, engine room, crew space and after peak. The bunkers have a capacity of nearly 100 tons of coal. The equipment and outfit are very complete, including a steam windlass, steam steering engine and steam tow-rope winch.

Steam is supplied by two boilers, each having a heating surface of 2,045 square feet. They are fitted with Schmidt superheaters of the smoke tube type, and provide steam at 230 pounds pressure, superheated to 650 degrees Fahr. This steam is led to two triple expansion engines of the jet condensing type, each engine developing 700 indicated horsepower. The coal consumption proved to be very good, being as low as 1.27 pounds per indicated horsepower. When the superheaters are put out of action, the coal consumption rises to 1.57 pounds, still a very good record for engines of this class.

It is evident that no single propeller can be designed for 700 indicated horsepower on a 6-foot draft. The builders therefore decided to fit more than one propeller on each shaft. In order to secure the highest efficiency for each draft, two different sets of propellers are provided—i. e., one set of two propellers on each shaft for the normal draft of 6 feet 7 inches, corresponding to 90 tons of coal in the bunkers, and a set of three propellers of smaller diameter on each shaft for the light draft of 5 feet 7 inches, corresponding to 20 tons of coal in the bunkers, an arrangement which has proved entirely satisfactory.

Floating Salvage Crane

A self-propelled floating steam crane of 30 tons capacity is being constructed by Ritchie, Graham & Milne, Glasgow, for delivery at Rio de Janeiro, Brazil. The crane is mounted on a hull 150 feet long, 50 feet beam and 8 feet molded depth, built of steel according to Lloyds, with the necessary accommodation for officers, crew and two divers. The 30-ton crane and a 5-ton steam crane were supplied by Sir William Arrol & Company, Ltd. There is also a complete set of diving apparatus, a submarine exploding plant, and pumping apparatus supplied by Messrs. Siebe Gorman & Company, Ltd. The vessel is fitted with two sets of compound surface condensing engines, supplied with steam by two Babcock & Wilcox watertube boilers. After completion and trials the vessel will be prepared for a sea voyage to Rio de Janeiro.

Tunnel Stern Motor Passenger Vessel

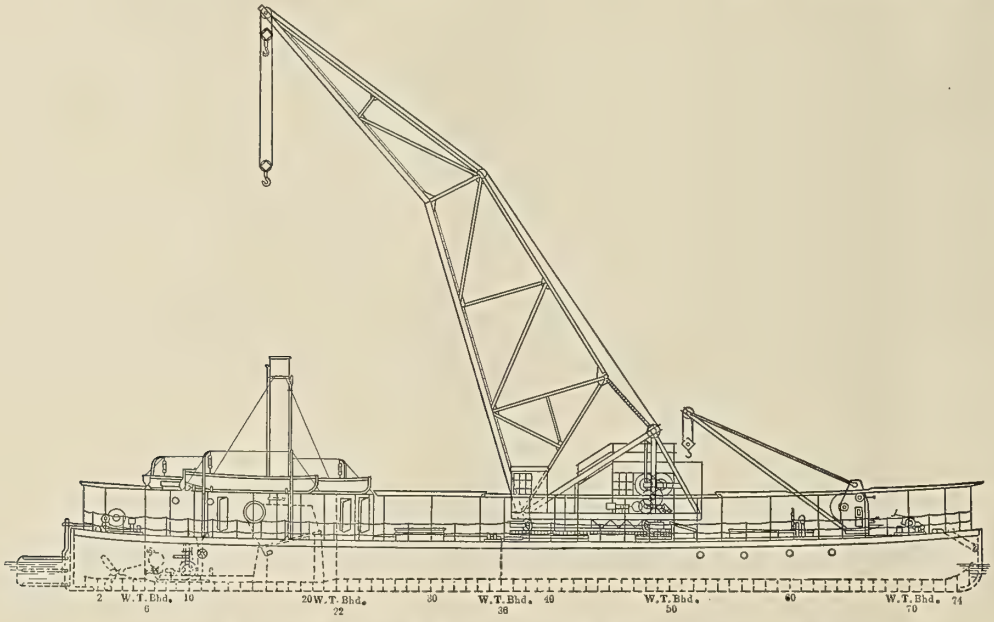
A 95-foot twin-screw tunnel motor passenger boat was built recently for the Northern Steamship Company, of Auckland, New Zealand, by Messrs. John I. Thornycroft & Company, Ltd., Southampton, to be used for harbor and river service.

The boat was designed with light draft in order to enable it to pass over shallow bars. With a load of 10 tons the draft is 2 feet 3 inches, and at this draft the boat will be driven at a speed of 11 knots by two sets of Thornycroft S-4 type kerosene (paraffin) engines.

The machinery is placed amidships with cargo holds forward and abaft. A promenade deck with steel framing is fitted over the upper deck, giving ample space for passenger accommodations. An electric and hand windlass is fitted forward to work the ship's anchors and also for warping.

The vessel is lighted throughout with electricity, current being supplied by a separate generator worked direct off a kerosene (paraffin) motor. Combined in the same bedplate, and worked by the same motor, are the bilge pump and an auxiliary air compressor.

The hull is built of mild steel plates and angles, the shell plating being galvanized. After the trials were completed by the builders the vessel was hauled up, disconnected and shipped in knock-down form to New Zealand.



SELF-PROPELLED FLOATING CRANE OF 30 TONS CAPACITY DESIGNED FOR SALVAGE WORK

225-Ton Floating Crane

What is said to be the largest floating crane in the world is under construction by William Chalmers & Company, Ltd., Rutherglen, for use in the construction of the naval harbor Talcahuano, Chile. On a steel pontoon, 110 feet long by 70 feet wide by 12 feet deep, is mounted a non-revolving crane of 225 tons capacity at a reach of 90 feet. Powerful steam winches are provided for placing the pontoon in position and for slewing. The total displacement at maximum load at maximum radius will be 1,140 tons, including the ballast in the tanks to counterbalance the load.

This crane will be used by the contractors in placing large monoliths in position that are to form the sea wall and breakwater in the harbor of Talcahuano.

Twin Screw Passenger and Cargo Steamer St. Patrick

The *St. Patrick* illustrated on this page is a twin-screw passenger and cargo steamer of shallow draft, built by Messrs. John I. Thornycroft & Company, Ltd., at Southampton, to the order of the Crown Agents for the Colonies for service at Trinidad. The vessel was completed at the builders' works, and is now steaming out to her destination. In most respects she is similar to the *Naparima* built by Messrs. Thornycroft for the same service some years ago, but the new boat is considerably larger, her length being 180 feet, the beam 27 feet and the depth 7 feet. On a draft of 3 feet the vessel is propelled by two sets of triple-expansion engines, driving tandem twin screws housed in tunnels at the stern at a speed of 14½ knots.

TWIN-SCREW TUNNEL STERN STEAMER ST. PATRICK

The hull is built of steel and divided into seven watertight compartments by six athwartship bulkheads. Ample space for cargo is provided in the holds forward and abaft the machinery space. Passenger accommodation is arranged on the upper and promenade decks. Four cabins, suitable for the officers of the vessel, are at the forward end of the upper deck. The galley, dining saloon, lavatories, etc., are placed aft on the same deck, the promenade deck being given up entirely to the passenger accommodation.

The tunnel type of boat was adopted in order to reduce the weight to a minimum and to give the screws good protection in shallow water. Steam is supplied by a single water-tube boiler placed in an inclosed stokehold, the boiler being worked under forced draft. The rudders are worked by a steering engine placed at the after end of the engine room and controlled by a steering wheel fitted at the forward end of the awning deck. Four derricks are fitted for handling cargo, and two 18-foot lifeboats are slung from davits at each quarter.

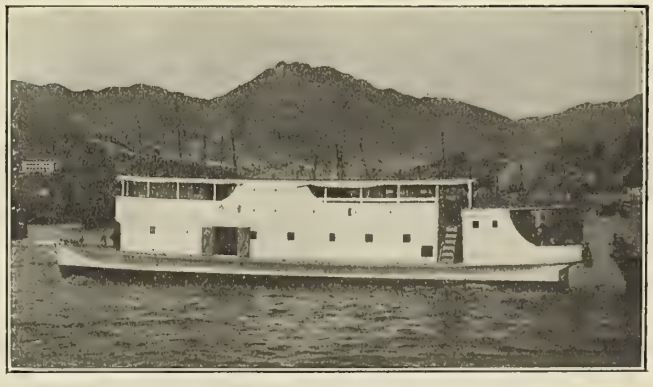
For the voyage out to her destination temporary wooden bulkheads and a turtle deck were fitted in order to ensure the vessel's seaworthiness.

Tunnel Stern Twin Screw Gasolene (Petrol) Towing Launch Yasica

During the last year the Gas Engine & Power Company and Charles L. Seabury & Company, Con., Morris Heights, New York City, designed and built for the Cuba Planters' Company a twin-screw tunnel-stern gasolene (petrol) launch for use as a towboat for towing banana barges and also for carrying their workmen from town to the plantation and return. The general dimensions of the launch are: Length over all, 32 feet; beam, 9 feet; draft, 1 foot 6 inches; speed, 9 to 10 miles per hour. The launch is an open boat with large cockpits, both forward and aft, with seats on each side for carrying the workmen. The machinery, located amidships, consists of two three-cylinder, four-cycle 4½-inch bore by 5-inch stroke Speedway marine gasoline (petrol) engines of 18 horsepower each, enclosed under sliding hatches and arranged for control by the engineer.

Chinese River Boats

Four river boats for passenger, light cargo and mail service were built recently at Hongkong, China, by Chinese builders. Three of the boats are 66 feet long, 13 feet 6 inches beam and 3 feet 6 inches molded depth, equipped with four-cylinder, four-cycle, 60-brake horsepower kerosene (paraffin) Djinn engines, manufactured by Messrs. Brazil, Straker & Company, Ltd., Vulcan Iron Works, Bristol. Each of these vessels



MOTOR BOAT BUILT IN CHINA FOR RIVER WORK

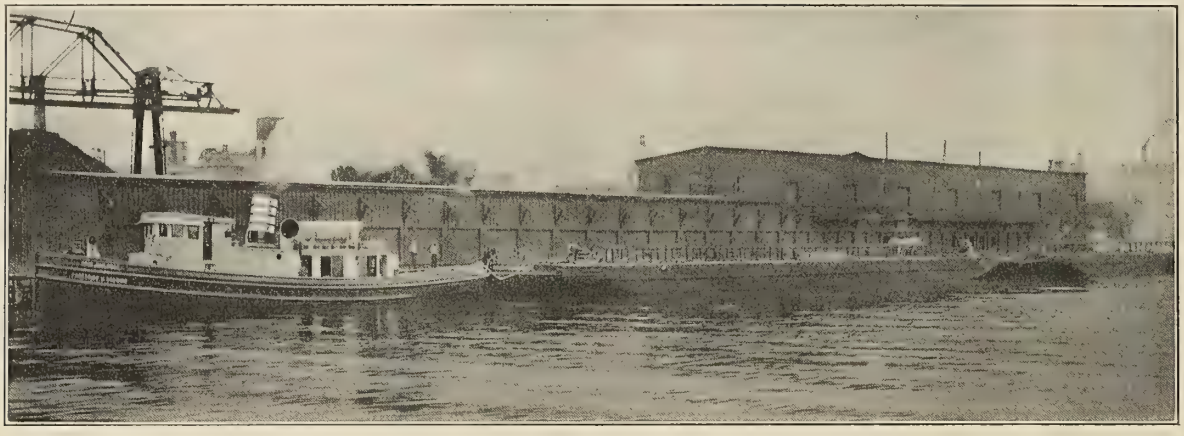
maintained a speed of 8¾ knots on the official trial run from Hongkong to Wuchow, a distance of 250 miles. The fourth vessel is a larger boat, having a length of 86 feet, but the beam and molded depth are the same as in the others. This boat, however, is equipped with a six-cylinder, 160-brake horsepower Djinn engine, which enabled her to maintain a speed of 10¼ knots on the trial run from Hongkong to Wuchow. On this boat an auxiliary engine drives a dynamo for electric light, including a 19-inch searchlight, and the service pumps.

The engines and all accessories for these boats were built to the order and under the personal supervision of Messrs. R. Wilson & Sons, of Laygate Circus, South Shields, with a special view to the service for which they were intended.

Steel Tug Frederick U. Robbins and Car Floats for the Erie Railway Service

When President Underwood, of the Erie Railroad, was asked recently where the new tug *Frederick U. Robbins,* under construction by the Manitowoc Ship Building & Dry Dock Company, of Manitowoc, Wis., would go into commission, he replied: "We are going to use the Chicago River for a railroad yard and the new tug will be used for towing the car floats there."

Two car floats are now in the Erie service in Chicago which were also built by the Manitowoc Ship Building & Dry Dock Company. They are 175 feet long, 32 feet wide and 8 feet deep, fitted with double tracks and carry eight cars each. A trucking platform is located between the two tracks and is on a level with car floors, enabling any or all of the cars to be unloaded. The cars are loaded at a central slip and towed to the various warehouses or boat docks that have no railway connections, and here unloaded. These floats are sheathed above the waterline with nine inches of fir and oak,



NEW ERIE TUG AND CAR FLOATS FOR SERVICE ON CHICAGO RIVER

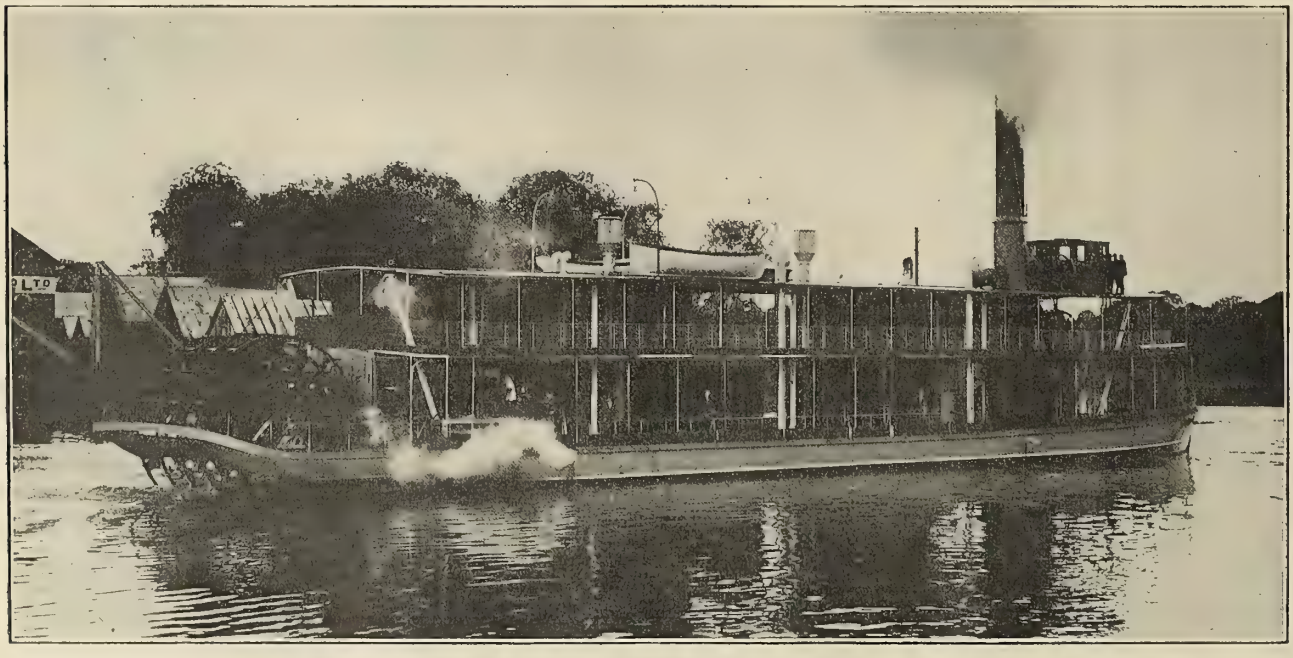
The new tug is of steel construction throughout and is 87 feet long overall, 22 feet beam and 13 feet depth. She is constructed for year round service and the waterline strake throughout and all bow plating have been doubled for ice work. Steam is furnished at 130 pounds pressure by a firebox marine boiler 10 feet 6 inches diameter by 14 feet long. Propulsion is by an 18-38 by 30-inch condensing engine with attached air pumps, feed pump, bilge and cooler pump. To comply with the smoke ordinance of the city of Chicago, the *Robbins* has been equipped to burn hard coal. Forced draft is furnished by a Sirocco fan driven by a Terry turbine.

Of up-to-date construction in every way, this powerful tug has a steel deck house and pilot house, steam steering gear and an electric plant. Sleeping quarters are provided aft for eight men with galley and mess in the hold forward.

and are built for hard usage and of exceptionally heavy construction, having a longitudinal girder under each track. The floats are subdivided into nine compartments by watertight bulkheads.

Stern Wheel Steamer for the Congo

A number of large stern-wheel steamers have been built recently by Lobnitz & Company, Ltd., Renfrew, for service on the River Congo. Most of these vessels are of a very similar type, the dimensions varying but little. During the last year three such vessels were shipped to the Congo, one of which is illustrated. With a hull 171 feet long between perpendiculars, 30 feet breadth molded and 7 feet depth molded, the boat is of ample size for freight and passenger service. Propulsion is by



ENGLISH-BUILT STERN WHEELER ON THE CONGO RIVER

a stern-wheel, driven by compound surface condensing engines, with cylinders 21 and 42 inches diameter by 54 inches stroke. Steam is supplied at 130 pounds working pressure by two boilers of the locomotive type, fitted with a forced draft inclosed ash-pit system to enable the burning of wood as fuel, or the boilers can be arranged for burning oil fuel on the pressure system. The main auxiliaries include an independent surface condensing plant fitted with Weir's air and feed pumps and a centrifugal circulating pump.

Large Motor-Driven Ferry, Bridgit

In considering the construction of a ferryboat to be used in connection with the new line of the Oakland, Antioch & Eastern Railway from Sacramento to San Francisco, Cal., it was decided that a gas engine installation would meet the requirements of this service far more economically than steam engines, and, consequently, the new ferryboat, *Bridgit,* was equipped with a 500 horsepower unit built by the Union Gas Engine Company, of San Francisco.

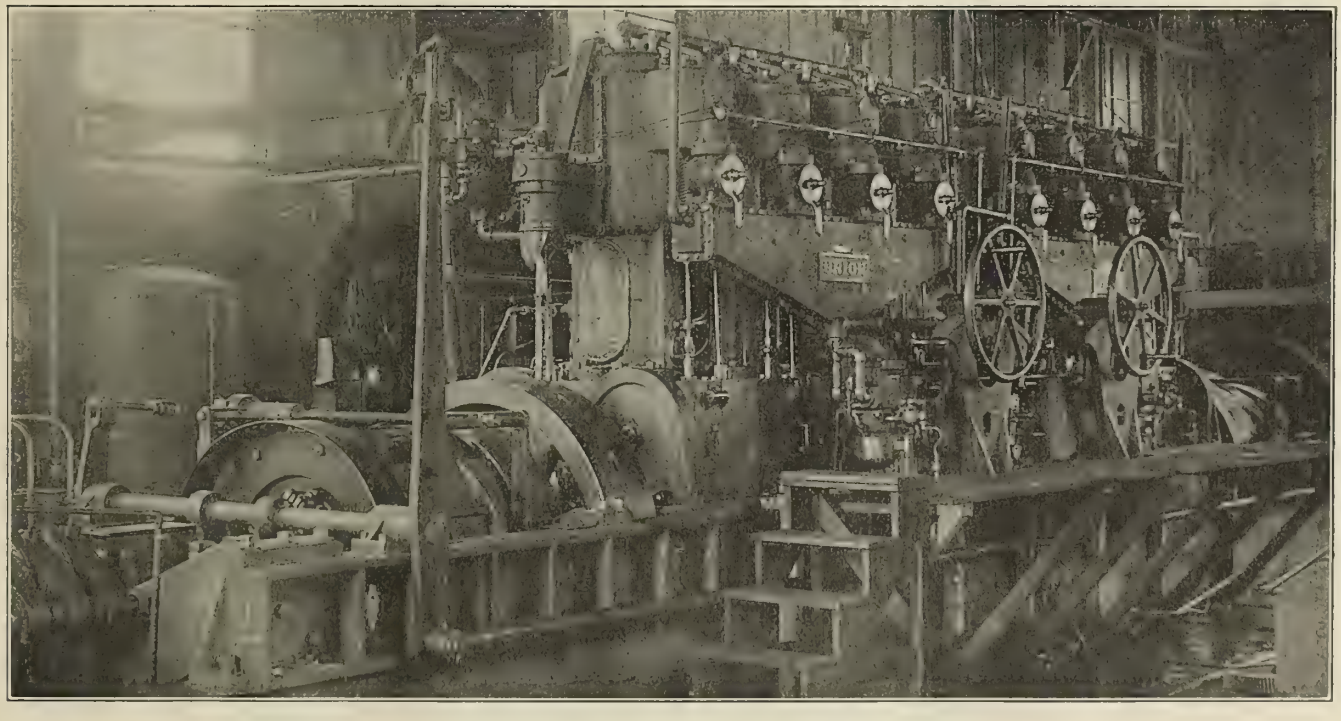
This vessel makes sixteen regular trips every day, carrying passenger and freight trains weighing from 350 to 400 tons. Her overall length is 186 feet, and her beam is 57 feet, providing space for three tracks on the deck, each track being of sufficient length for three cars. The hull is of wood and is reinforced by longitudinal trusses in order to secure rigidity.

The propelling engine is of especial interest, as it is said to be the largest marine distillate engine ever built. It is an 8-cylinder, 500 horsepower unit, weighing approximately 90,000 pounds, and is more than 40 feet long. It is known as the open crosshead type of engine, that has been so successfully developed by the Union Gas Engine Company. The cylinders are exceptionally long, the lower ends being open on either side and serving as crosshead guides characteristic of steam installations. The engine is placed in the center of the vessel, being connected through disk clutches to propellers at either end. The wheels are of opposite pitch, and reversing is accomplished by whichever propeller is at the forward end of the vessel, as the vessel is double-ended.

In addition to the main engine, there is a 40 horsepower electric lighting and pumping engine and an 8 horsepower pumping engine. A 500-volt generator is used in the lighting set, in order to supply current for lighting the cars; the vessel's lights are also supplied from the same source.

MOTOR RAILWAY FERRY BRIDGIT

A pneumatic steering-gear is provided, and, in addition, there is a hand-controlled gear that may be used in emergency. The operation of this vessel has been watched with considerable interest, as the engine room crew consists of only one man, a fact which gives an idea of the ease of handling and the reliability of this type of engine.



500-HORSEPOWER OPEN CROSSHEAD UNION ENGINE FOR FERRYBOAT BRIDGIT, ERECTED IN BUILDERS' SHOP

CORRECTION.—In the article on "Bearing Pressure on Guide of Paddle Engines," published on page 401 of our September issue, the words "in tension" in the top line of the second column should read "in compression."

American Steamers on the Magdalena River

The Magdalena River, in the Republic of Colombia, South America, is very much like the Missouri River, in the United States, except that the latter has a length of 3,000 miles while the distance from the mouth of the Magdalena to the rapids at Honda is only 600 miles. Navigation on the lower river for 30 miles below Honda is through rapids similar to those in the upper Missouri River between the mouth of the Mussel Shell River and Fort Benton. These rapids also have the same characteristics as those in the Alleghany River, but the rapids at Honda, which are one mile long, are far more turbulent, resembling the rapids below Niagara Falls. Light-draft steamers are able to go through these rapids without cargo during high water with the aid of two or three very large hawsers taken to the steam capstans, and above them the upper river can be navigated for 150 miles by vessels carrying from 80 to 100 tons of freight.

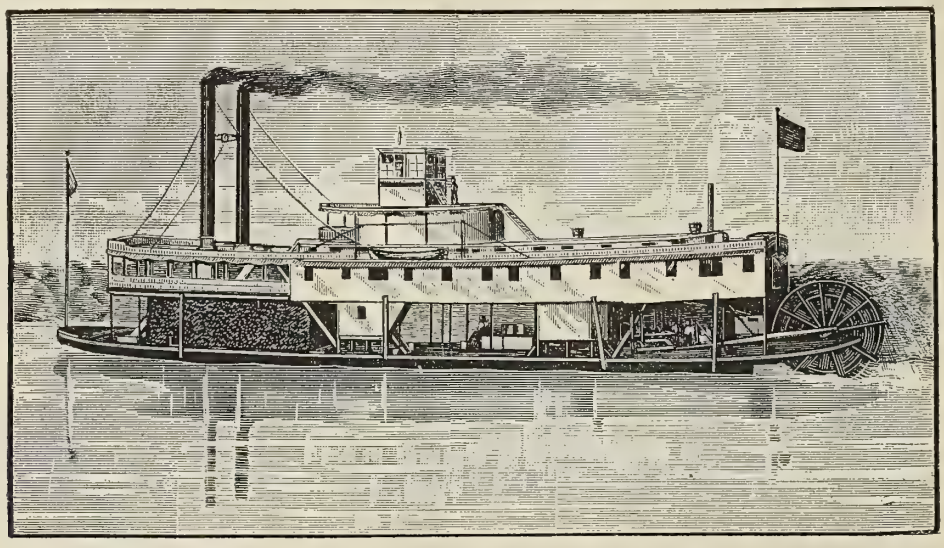


FIG. 1.—STEEL STERN WHEEL STEAMER FRANCISCO MONTOYA, BUILT BY JAMES REES & SONS COMPANY, PITTSBURG, PA., IN 1878, FOR SERVICE ON THE MAGDALENA RIVER

First American Steamers to Navigate the Magdalena

Navigation of the Magdalena River by stern-wheel steamboats of American build was begun soon after the close of the Civil War, in 1865. Previous to this date the river was navigated by large side-wheel boats built in the East and in Europe. The first stern-wheeler on the river was a composite boat built with iron frames and teak planking, which was designed by an American, but the draft of this boat proved too great for successful navigation.

Early in the seventies two Colombian steamboat captains visited America to examine the boats navigating the Western rivers. After inspecting the Ohio River steamboats and finding them suitable for navigating the Magdalena River, contracts were made for the construction at Pittsburg and Cincinnati of eight wood stern-wheel boats, four of which were named the *Isabelle, Barranquilla, Murillo* and *Colombia.* These boats were sent out under their own steam, coasting from New Orleans to the coast of Florida, thence to Cuba, Haiti and Jamaica, and from these islands, when the weather permitted a safe crossing, across the Caribbean Sea. This was continued until about 1874, when one of the boats built at Cincinnati was caught in a storm after leaving the mouth of the Mississippi River and was lost with all on board.

Wooden Hulls Found Too Costly

After the loss of this vessel, the companies operating steamers on the Magdalena River resorted to the scheme of having the wooden frames worked out in the United States and then the boats were erected in Colombia under the direction of a few skilled mechanics brought down from America. It was found, however, that the life of a wood-hull steamer in the tropics did not exceed five years without entirely rebuilding the hull, and, as this was done at a price which usually exceeded the original cost of the hull, attention was directed to the building of steel-hull steamers with watertight compartments, a type of vessel which proved successful and was universally adopted by all the steamboat companies.

The First Steel Stern Wheel Steamer

The first steel stern-wheel steamer to successfully navigate the Magdalena River was the *Francisco Montoya,* built by James Rees & Sons Company, Pittsburg, Pa., in 1878. This, by the way, was the first steel-hull river steamer constructed in America. She was 150 feet long, 29 feet 6 inches beam, with a depth of hold of 4 feet. The draft, with 75 tons of fuel on board, was 26 inches. Steam was supplied by two tubular type boilers, 45 inches diameter and 17 feet long, to two high-pressure engines 15 inches diameter and 5 feet stroke, fitted with Rees adjustable or variable cut-off. The design and plans for this type of river steamer were perfected in 1875, but, owing to the opposition that existed against the use of steel hulls on rivers having a rocky bed, the vessel was not built until three years later. In fact, at that time rumors were published to the effect that the constructor of such a boat was a fit subject for a lunatic asylum, as it was contended that if a steel-hull boat struck a bank or a sand bar in the river the boat would fall asunder or break to pieces like a watch spring. However, the superintending engineer of the steamboat company was finally sent to inspect the material, which was crucible homogeneous steel of from 70,000 to 85,000 pounds tensile strength, costing 7 cents per pound. Test pieces from the plate were heated cherry red and dipped in cold water and also case-hardened. In fact, almost every conceivable test was made, and it was found that every piece turned over flat on itself without a

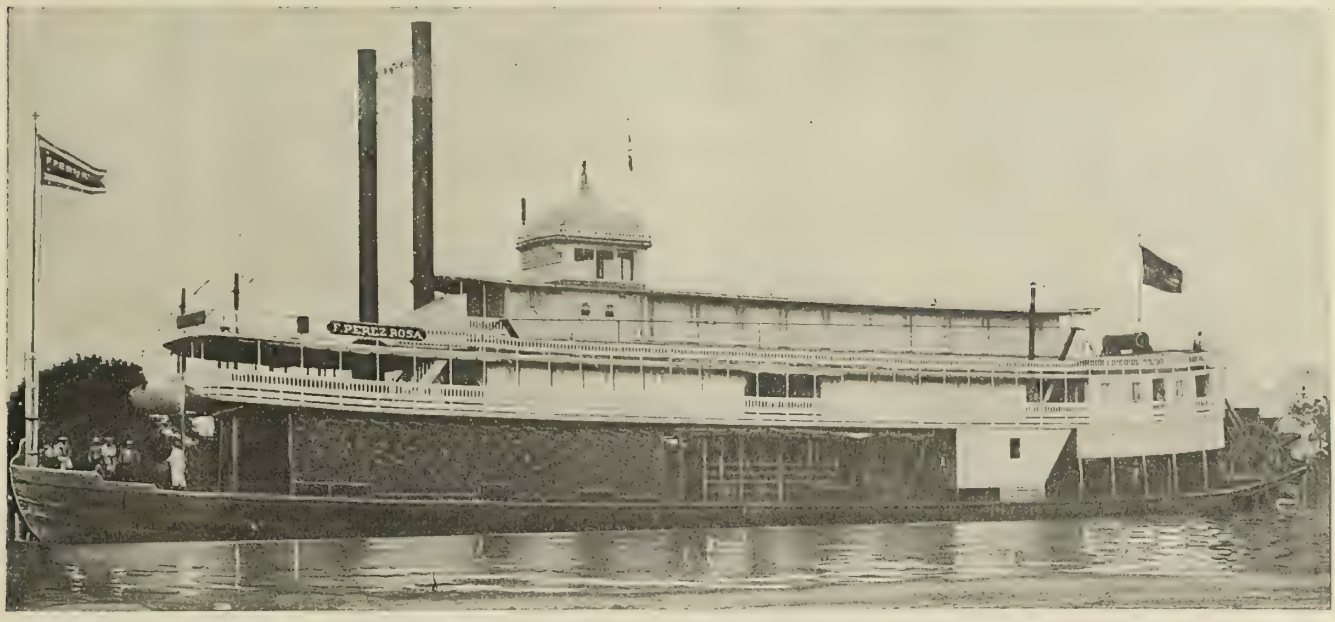


FIG. 2.—STEAMER F. PEREZ ROSA, A TYPICAL MODERN AMERICAN-BUILT RIVER STEAMER ON THE MAGDALENA RIVER. LENGTH, 170 FEET; BEAM, 33 FEET; DEPTH OF HOLD, 4 FEET 6 INCHES. CAPACITY, 450 TONS; SPEED, 15 MILES PER HOUR IN DEAD WATER

fracture. The material was finally accepted, and, in his report, the engineer stated that it was the finest material he ever saw for plating a steam vessel.

The keel was laid in Barranquilla on Nov. 26, 1878, and in exactly two months steam was raised on the boat, and on Feb. 13, 1879, she started up the river on her maiden trip with 75 tons of freight and five hours' fuel on board, drawing 26 inches of water. Although the water was low, the maiden trip was made within three hours of the running time of the fastest trip ever made on the river. Captain T. M. Rees, general manager of the Rees firm (constructors of the vessel), personally supervised the erection of the vessel, and also its opration on its trial trip.

The boat had twenty-one watertight compartments. The longitudinal bulkheads were secured to the keel and bottom of the boat and floor frames by steel-flanged intercostals which were patented by James Rees. The thickness of the steel plate and framing was based on the construction of the Alleghany River packet boats, 1/16-inch thickness of steel plate being used for every 1-inch thickness of No. 1 white oak used in the wood hulls. This practice, it has been found even to the present day, insures a boat as strong, if not stronger, than a similar boat built of wood.

PRESENT TYPES OF VESSELS ON THE MAGDALENA

Almost as many types of steam vessels have been tried out on the Magdalena River as have been tried in America. Vessels built of good yellow pine, Spanish cedar, teak, iron and steel, and boats with side wheels, recess wheels, screw propellers, and half submerged twin screw propeller boats with wheels and "walking sticks" to propel them over bars, have been built, but none of these vessels has seemed to fulfill all of the requirements as well as the light-draft steel boats with longitudinal and athwartship bulkheads forming from twelve to twenty-five watertight compartments. To prolong the life of such vessels, the hull plate is usually galvanized and all seams are double riveted, mainly with cold rivets. The thickness of the plate runs from No. 12 to No. 6 gage, all

FIG. 3.—MAIN CABIN ON SALOON DECK OF STEAMER F. PEREZ ROSA

being of the best open-hearth steel of from 60,000 to 65,000 pounds tensile strength, in accordance with the size of boat, which ranges from 100 to 500 tons capacity.

The large boats built by the Rees firm now navigating the Magdalena River are 170 feet long, 33 feet beam and 4 feet 6 inches depth of hold, carrying 90 tons of freight on 28 inches draft at a speed in dead water of 15 miles per hour. Power in the large boats runs from 300 to 400 horsepower, and, when there is plenty of freight on the river, the large boats take from 1 to 4 light-draft steel barges in tow, carrying from 50 to 75 tons of freight in each barge. Figs. 2 and 3 show views of the latest of these boats, which was completed in 1911. The total tonnage capacity of the boat is 450 tons and her dimensions are the same as mentioned above. Steam is supplied by three tubular boilers, 48 inches diameter and 15 feet long, to high-pressure engines, 15 inches diameter by 6 feet stroke, fitted with a Rees adjustable or variable cut-off. What is practically a duplicate of this vessel is now under construction by the Rees firm in Pittsburg for the same company, except that the new vessel will have increased engine power and larger passenger accommodations.

"During the revolution of 1899-1901 one of the Rees boats, the *Helena,* was captured by the rebels, who converted her into a gunboat by installing several guns and piling sacks of salt along the sides for breastworks.

"During a night engagement on the river between the rebels and the Government fleet, the *Helena* by mistake rammed at full speed a heavy steel dredge belonging to their own fleet in an attempt to ram the Government gunboat *Hercules.* The dredge was cut almost completely in two and sank immediately, and the *Helena,* coming under fire from the entire Government fleet, had all her upper works riddled and about everyone on board either killed or wounded. The vessel drifted alongside the *Barranquilla* and was captured. The heavy wrought iron stem and the bow plating of the boat were twisted into a knot but not broken; the forward collision bulkhead held and the boat did not leak a drop. She was towed down the river and lay at Barranquilla for at least a year before the company got her back from the Government.

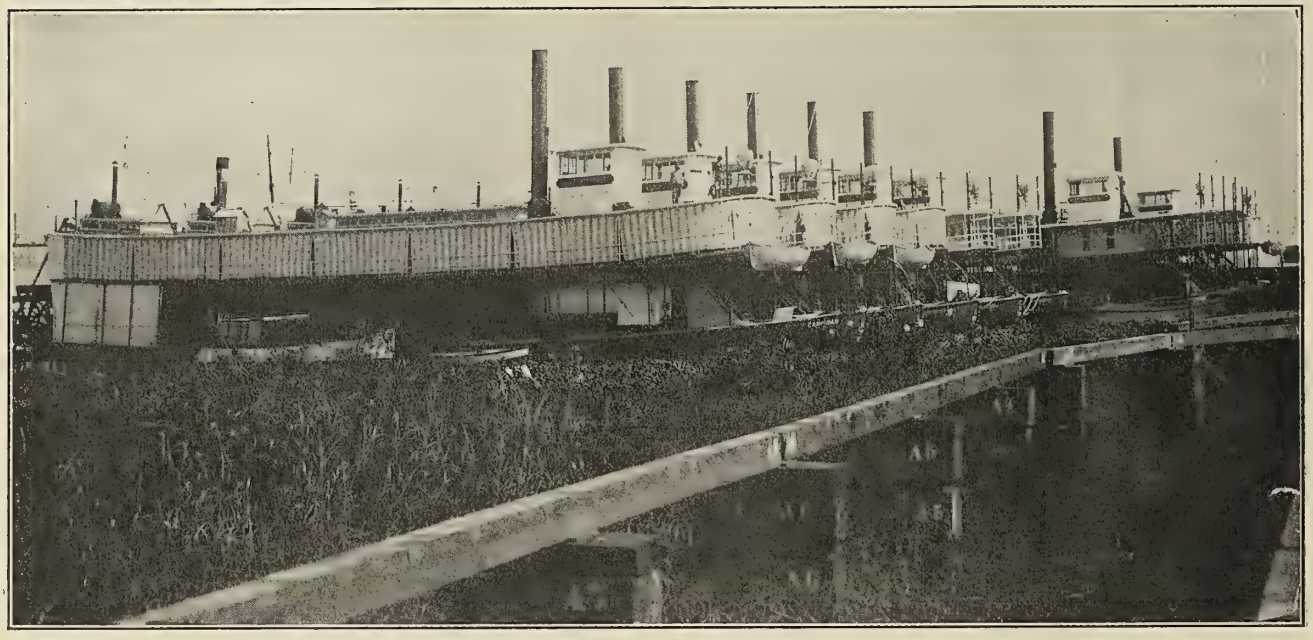


FIG. 4.—FLEET OF 14 REES STERN WHEEL STEAMERS ASSEMBLED AT PARA, BRAZIL, IN 1912

Comments by an American Engineer

Some interesting comments on steamboating on the Magdalena River were made recently by Captain B. L. Wooster, a mechanical engineer who has been in South America for over twenty years supervising the erection and operation of many of the stern-wheel boats built in the United States. He says: "At present there are no wooden-hull steamboats or barges on the Magdalena River; they are all of galvanized steel. The steamers are stern-wheel boats and were built in Germany, England and the United States. There is no doubt that the steel hull, if properly constructed, is far superior to either wood or composite construction for this service.

"During the low stages of water, the Magdalena River consists of a series of deep pools separated by sand-bars, over which there are at times not more than 3½ feet of water, and it is a frequent occurrence to find several boats tied up below these bars waiting for a Rees boat to come along, as these boats invariably hit these bars at full speed, stop the engines, and when the following wave runs up start up again and dig their way over the bar, making a channel through which the other boats follow. This channel soon fills up and has to be opened up again by the next boat up or down the river. When she was taken over for repairs she was still dry and the bones of two men were found in the hold, where they had probably crawled after being wounded and had been overlooked by the Government troops when they took the boat.

"Many boats which the writer has erected in Colombia and in Brazil on the Amazon were put together by native labor, and as a rule the natives proved very good workmen. The boats are operated entirely by natives, and, in spite of the fact that they were previously unfamiliar with the machinery, they handled them very well."

Zulia River Opened to Navigation by a Rees Boat

A sequel to the success made by the Rees firm with the construction of the *Francis Montoya* on the Magdalena River is found in the design for a boat which they have built for operation on the Zulia River in Colombia. In 1880 the steel stern-wheel steamer *Venezuela,* designed to carry 60 tons of freight on 10 inches draft at a speed of 8 miles per hour, with a steam pressure of 120 pounds per square inch, was built. When completed, the mean draft of the boat was 9 inches, and on her maiden trip a speed of 8 miles per hour was made with 75 pounds of steam. As in the case of the *Francisco Montoya,* this boat was also erected and taken out on her maiden trip under the personal supervision of Capt. T. M. Rees, general manager of the Rees Company, and it can be truthfully said that the Zulia River was opened up to navigation by this firm.

Stern Recess Wheel Steamer Osceola

The steamer *Osceola,* under construction by the Merrill-Stevens Company, of Jacksonville, Fla., for the Clyde Steamship Company, is now nearing completion. It is a light-draft, stern-wheel steamer fitted for freight and passenger service on Florida rivers, and is of the following dimensions:

	Feet
Length over all	188
Length between perpendiculars	180
Molded depth at bow	12
amidships	8
at the stern	10
Load draft	5

The steamer is designed for an economical working speed of 12 miles per hour.

As will be seen in Fig. 1, the vessel has a straight stem, but owing to the stern wheel it has a double stern, one on each side of the wheel, leaving room on the sides for the main bearings, crank and connecting rods and a walk for the oiler, thus allowing ready access to these vital parts, as is all clearly shown in Figs. 2 and 3. These illustrations also show the construction at the wheel case, where the bottom is so formed as to guide the water to the wheel with the least possible chance for losses due to eddies and other hydraulic resistances. It should also be noted that the form given to the hull at the intersection with the wheel casing also has the effect that at a speed of 6 miles per hour and over the water will keep a uniform level at the point where the wheel buckets enter the water, which level is approximately at the angle where the bottom meets the wheel casing. This is a very important point, not only because it largely diminishes any tendency to vibration, but it also makes the action of the wheel on entering the water entirely independent of loading and of speed, and materially increases the efficiency of the propelling power.

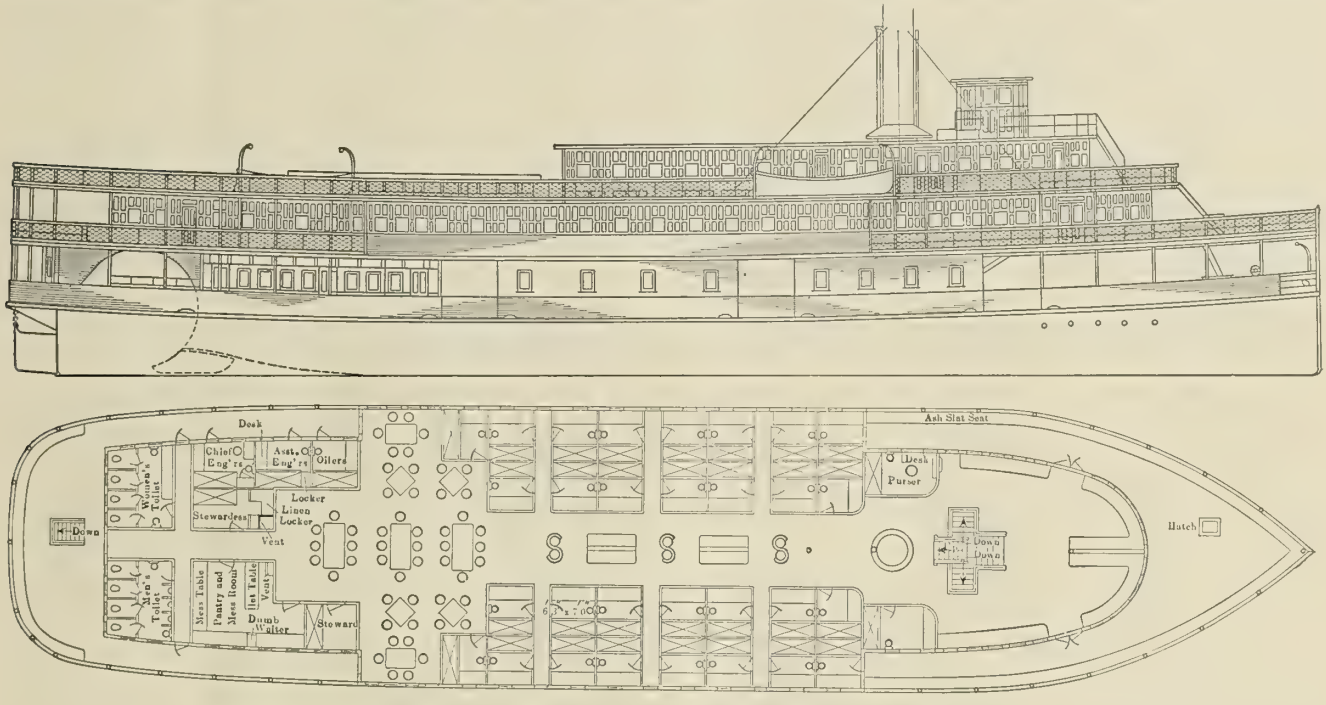


FIG. 1.—PROFILE OF THE OSCEOLA AND PLAN OF SALOON DECK

Wheel

The wheel, as can be seen in Figs. 2 and 3, is of the herring-bone type, allowing the buckets to enter the water gradually and without the splash and resulting vibration to the ship which would be the case with a wheel with straight buckets. It is strongly built of rolled steel bars on cast steel hubs, while the brackets that connect the buckets with the arms are also steel castings. The shaft is unusually heavy, and with the cross bracing all deflection of the shaft is absolutely avoided. Varying from the usual custom, the steel hubs are shrunk on and strongly keyed onto the round shaft.

Rudders

With a stern-wheel steamer, and especially with a wheel of the recess type, the proper arrangement of the rudders is of paramount importance to secure good steering qualities. The system of rudders as adopted on this boat combines the steering qualities obtained by the arrangement common with overhung wheels and the arrangement common with recessed stern wheels, giving the steering action from the wheel water both going ahead and backing independent of the headway. All the four rudders are connected to one Williamson combined hand and steam steering engine, which is operated through shafting and bevel gears from the wheel in the pilot house.

Hull Construction

As this is a very shallow hull compared to its length, and as the hull is necessarily so shaped that the side plating does not give any longitudinal stiffness, there are three heavy longitudinal girders running practically the full length of the boat. Of these the two outside ones are regular lattice girders, made up of heavy top and bottom chords connected by angle lattice bracing between, while the center one is a combination plate and lattice girder stiffened by heavy top and bottom angle chords, with angle bracing on both sides arranged similarly to the two lattice girders. This center girder also forms a bulkhead running the full length from the collision bulkhead at frame 5 to the wheel casing, and is broken only by two small door openings, one in the boiler room and one in the engine room, which are reinforced by heavy steel angles. To further assist in stiffening the hull, the dif-

ferent lengths forming the steel plate keel are welded together. Each floor frame is built up in the usual manner as Z girders, while there are four transverse bulkheads, thus dividing the hull into nine compartments. Those compartments forming the forecastle are fitted up as quarters for the crew.

A Providence deck steam capstan is placed forward.

The main deck beams are made of steel angles, one to each frame, and are tied to the frames by large gusset plates strongly riveted, and also supported by the longitudinal girders and angle stanchions. The 2½-inch Oregon pine deck

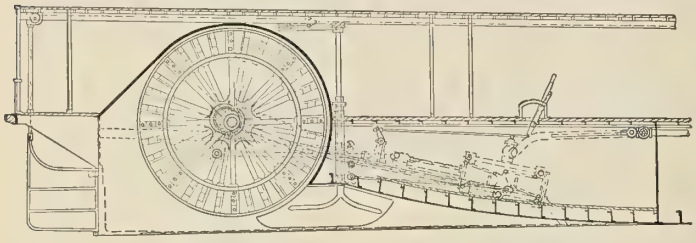


FIG. 2.—FORE AND AFT SECTION OF ENGINE ROOM

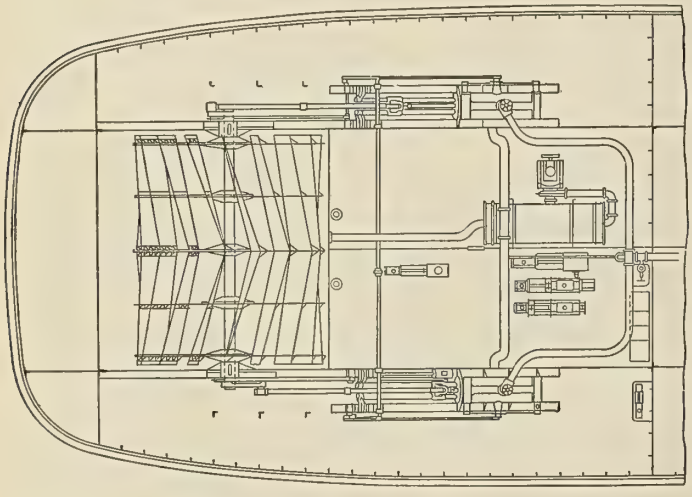


FIG. 3.—PLAN OF ENGINE ROOM

is protected from wear in handling the cargo by a sheathing of yellow pine.

This system of longitudinal girders and frames forms an unusually stiff hull free from deflection due to uneven loading.

MACHINERY

There are two 24-inch by 72-inch single-cylinder reversible condensing engines of the Corliss valve type, one on each side of the ship and connected direct to the wheel shaft, the cranks forming an angle of 90 degrees. These engines were built by the Merrill-Stevens Company, and designed to suit this purpose, and to give the best efficiency at the normal working load of 600 horsepower, while a maximum power of over 1,000 horsepower may be obtained. Each engine is mounted on two heavy angle and plate frames, which also carry the main bearings, and are strongly riveted to the frames and girders forming the hull.

There are two boilers of the Scotch type, with corrugated furnaces, and they are placed well forward so as to balance the weight of the engines. They are fitted to burn either coal or wood. Over the boilers, and built inside the breeching, is a Foster superheater large enough to give 100 degrees superheat with 120 pounds pressure.

The engineer's stand is over the starboard engine, from which he operates a reverse engine of the steam ram type. He may also reverse the engines directly by hand, and within easy reach is the throttle stand.

In the compartments between the engines are located the condenser, with a centrifugal circulating pump, a feed-water heater, hot-well, air pump, and all the different pumps for boiler feed, bilge pump, general service and fire service. In the selection of the power and steam plant nothing has been spared to secure high efficiency with least possible weight, and to cut down the consumption of fuel to a minimum.

The different compartments of the hold and the engine room and the galley on the main deck are all supplied with ventilators, the two last ones terminating above the hurricane deck.

GENERAL ARRANGEMENT

On the main deck are compartments for the galley, white and colored deck passengers, and an enclosure for the boilers and superheaters. The balance of this deck is reserved for the cargo.

Above the main deck are the saloon, hurricane and texas decks, above which is placed the pilot-house with a bridge extending out to the sides of the ship.

As the owners desired a very light boat of low load draft, the superstructure was built as light as is consistent with strength. The carlins are run in one continuous length the full width of the deck, and where they are not supported by bulkheads and partitions they rest on intermediate strongbacks, on a system of headers and columns. These decks and the pilot-house are held down by the rods along the sides concealed in the walls.

On the saloon deck, as shown in Fig. 1, is the social hall forward, up to which leads the stairway from the main deck, while above this is the stairway to the texas. This main stairway may be entered from either side of the main deck, from which it is separated by double doors and paneled partitions conforming to the general finish above. Hand-rails, balusters and newel posts of both these stairways are of polished mahogany, handsomely molded.

Next to the stairway on the port side is the purser's room, while amidships are thirty-one staterooms for first class passengers, each with two berths, washstands and upholstered settees. Aft of these is the dining room, with a seating capacity of fifty persons, while aft of this is the pantry, connected by a dumbwaiter with the galley below, and quarters for the steward, stewardess, engineers and oilers; all of them fitted with washstands and lockers. Furthest aft are the toilets for men and women passengers.

In the texas is the captain's room, located forward, with the windows so placed that he has a full view all around. Next to this is the smoking-room, provided with upholstered seats, quarters for the mates and the pilots, and eight staterooms for passengers fitted up the same as the staterooms on the saloon deck. It will be seen that this gives stateroom accommodation for seventy-eight first class passengers. On the hurricane deck is also placed the regulation lifeboats, handled by the usual davits.

Both of these decks are provided with slatted seats along the outside railings for the accommodation of the passengers, while outside-stairs give the crew access to the decks and the pilot house without interfering with the comfort of the passengers.

The inside walls in the social room, dining and smoking rooms, passageways and around the smokestack are finished in panels broken by fluted pilasters at the corners and intermediate pilasters at the walls, where two staterooms are built together, all painted white enamel.

VENTILATION AND LIGHT

All of the staterooms are well ventilated by perforated panels below and by a row of grillwork worked into the molding overhead, while the inside staterooms on the saloon deck are lighted, and get additional ventilation from a row of fanlights placed under the seats in the texas. These fanlights are of ribbed glass, giving privacy in the staterooms, and they are so hinged that when opened they still obstruct the view from the outside. It is worthy of mention that all the windows are

extra large, balanced by Pullman spring sash balances, and they may be opened to a height that is unusual aboard ships. Each window is provided with blinds that can also be raised out of view. The doors to the officers' rooms are provided with blinds inside of the paneled door.

The dining room gets additional light and ventilation from a monitor above, with windows swinging out, and while open they are protected by the overhanging roof. This monitor is also finished in white panel work, while the ceiling is supported by a system of ribs between the windows, and the intersections of these ribs are supported by fluted columns conforming to the general finish on this deck.

Light is furnished by a 10-kilowatt "Spiro" turbine generator. There are single lamps in all the staterooms and in the passageways, while in the social hall are five dome lights, and similar dome lights in the dining-room and smoking-room. Besides these there are Pullman berth reading lights over the seats along the walls in the social hall and the smoking-room. On top of the pilot-house is a powerful searchlight controlled from inside the pilot-house.

The hull, boilers and machinery of the *Osceola* were designed by Mr. Stevens, president and naval architect of the Merrill-Stevens Company.

Seamless Steel Shallow Draft Motor Launches

The Seamless Steel Boat Company, Ltd., Wakefield, has built a number of different types of shallow-draft motor launches for service on the rivers in South America, Egypt

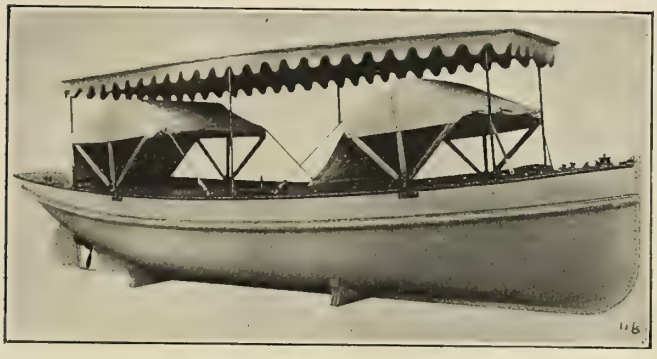


FIG. 1

and India. These boats are built for commercial and general purposes, and range from 20 to 35 feet length and from 7 to 11 miles per hour speed. None draws over 2 feet of water, and the draft in most of them is limited to 18 inches. The

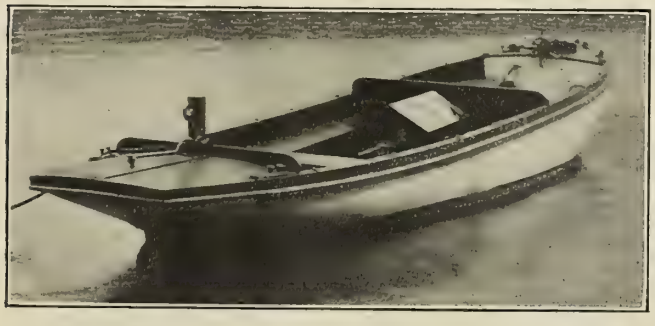


FIG. 2

simplicity of construction and completeness of equipment can be seen from the illustrations.

Fig. 1 is a motor launch 25 feet long, 6 feet 3 inches beam and 3 feet depth, supplied to a petroleum company for use in Egypt. Her hull has a graceful counter stern and is fitted with a canvas awning and folding canvas storm hoods, both forward and aft. The engine is a two-cylinder, 15-horsepower kerosene (paraffin) motor, which drives the boat at a speed of from 9 to 10 miles per hour on a draft of 1 foot 9 inches.

In Fig. 2 is shown a 30-foot launch which has a beam of 7 feet and a depth of 3 feet 6 inches, built for towing purposes in Brazil. The draft is 2 feet and the boat is propelled by a four-cylinder, 28-horsepower gasolene (petrol) engine at a speed of 10 miles per hour.

Oil-Engined Ferryboat

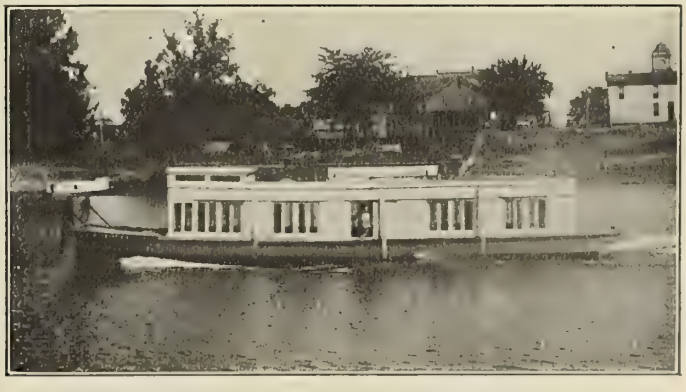
A well-modeled ferryboat, named the *Evelyn,* 80 feet long over all, 20 feet beam and 3 feet 6 inches draft, was built this season by A. Hansen, Brooklyn, N. Y., for the Ocean Beach Fire Island Company, Bayshore, L. I. She is built of wood throughout, with oak frames and yellow pine planking 2 inches thick. The keel and keelson are both 8 by 10 inches. Pro-

80-FOOT MOTOR FERRYBOAT EVELYN

pulsion is by twin screws, driven by two kerosene (paraffin) oil engines of 50 horsepower each, supplied by August Mietz, New York City. The boat's regular run from Bayshore, L. I., to Fire Island, is accomplished in 40 minutes, which is equivalent to a speed of 12 miles per hour. There is an upper deck above the main deck and a large cabin aft on the main deck, giving ample capacity for 250 passengers.

Passenger and Mail River Boat

The illustration shows a motor boat 44 feet long, 6 feet beam, drawing about 20 inches of water, propelled by a Standard gasolene (petrol) engine at a speed of a little over 10 miles per hour. This boat is operated on the Ohio River at Cal-



SHALLOW DRAFT RIVER MOTOR BOAT DOING MAIL SERVICE

houn, Ky., for carrying passengers and mail, a service which requires absolute reliability from the motive power in order to make connections with railroad trains.

Development of Producer Gas Motor Boats

Only a few years ago a producer-gas motor boat was looked upon as a novelty. The early installations were in the nature of experiments, and while striking advantages from this form of propulsion seemed possible, nevertheless most marine engineers were skeptical as to the actual results which could be obtained in practical installations. Mistaken conceptions as to the type of engine needed for operation on producer gas, as well as to the proper methods of operating such a plant, were prevalent, and naturally led to failures. Certain of the engine builders, however, took a deep interest in the matter and have thoroughly investigated the possibilities of producer-gas power, with the result that many successful installations of internal-combustion engines and gas producers have been made, with very satisfactory results.

FIG. 1.—BELGIAN TUG WOLVERINE IV, 59 FEET 9 INCHES LONG, EQUIPPED WITH A 75-HORSEPOWER PRODUCER GAS PLANT

One of these companies, the Wolverine Motor Works, of Bridgeport, Conn., has now in service, both in America and on the rivers and canals in Europe, a great many producer gas installations. Among these is the 66-foot yacht *Liline* (Fig. 2), fitted with a 36-horsepower Wolverine motor using producer gas as fuel. This yacht has made many crossings from Dover to Ostend in the kind of sea that is characteristic of the English Channel, and she has also navigated that part of the River Rhine known as Binger Loch, which is one of the worst rapids in the river, and which only boats with reliable power are able to navigate. Work boats fitted with similar producer gas installations are also very much in evidence on the Continent, in France, Belgium, Holland and also in England. The tugboat seems to be a favorite field for this kind of propulsion, and the skippers who are using producer-gas boats declare that they could never be induced to go back to oil or steam, as with producer gas the boats are handled better and prove more reliable and economical than any others.

Fig. 3 shows the *Ville de Bruxelles,* which is a typical example of the producer-gas work boat, used regularly between Ghent and Brussels. The illustration shows the boat just after arrival from Brussels with a cargo of 180 tons. The

FIG. 2.—PRODUCER GAS YACHT LILINE

cargo was piled on deck to a height of at least 6 feet, and the vessel was drawing about 6 feet of water. A similar outfit, carrying 500 tons of coal, has lately been put into commission running from Belgium into Germany. It is fitted with a 75-horsepower producer plant and a 75-horsepower Wolverine engine. This boat has entered into a contract to carry coal from the German mines to different parts of Belgium for a period of five years in competition with steam power and the railways.

A French company is installing three 36-horsepower Wolverine engines with gas producers on boats which are the beginning of a fleet of no small dimensions which it is proposed to use in French canals, where the present means of locomotion are still very crude, horses being used, and, in some cases, man power, to tow the boats through the canals. Gasoline (petrol) engines cannot be used for this purpose except in very small units where the cost of fuel is unimportant, as in many places in France gasolene (petrol) is as high as 50 cents (2/1) a gallon, and of inferior quality.

A number of interesting producer-gas installations have been made by the Wolverine Motor Works in the United States, particularly on the rivers and in coastal work. One producer-gas installation made on a boat in Florida enabled the owners to carry a ton of freight 160 miles at a cost for fuel of only 3 cents (0/1½). Fig. 4 shows an 85-foot schooner fitted with a 75-horsepower Wolverine engine and producer, which is engaged in the menhadden fishing industry. On her first trip out this vessel brought back 125,000 pounds of fish, and the cost of fuel for the trip was equivalent to the use of gasolene (petrol) at 2 cents (0/1) a gallon. Other installations of a similar nature are doing good work in Delaware and North Carolina and further installations are being made.

Among the chief advantages claimed for producer-gas installations the most important, of course, is economy. The consumption of fuel on producer-gas boats has been reduced to a very low quantity as compared with the cost of operation of the same boat on oil. Careful records kept in this connection show that the cost for operating a 36-horsepower Wolverine engine on producer gas for twelve hours was 84 cents (3/6), as against $5 (1/0/10) formerly spent for heavy gasoline (petrol). In fact, the cost per horsepower-hour has been reduced to about one-fifth of a cent (0/0/1-10).

Another thing in favor of this class of power is the reduction in the crew required. On most of the boats mentioned in this article there is, of course, a skipper or captain who navigates the boat and controls the engines, and a boy about 14 years old, whose business it is to oil the engines and about once an hour put from 25 to 50 pounds of coal into the producer, the plant requiring no other attention. While the boat is standing by and not in operation, the consumption of fuel is very small indeed. It is unnecessary to build a new fire if a small quantity of coal is consumed while the boat is not in operation. On an ordinary run, if the producer is properly

FIG. 4.—PRODUCER GAS MENHADDEN FISHING SCHOONER, M. M. MARKS

FIG. 3.—PRODUCER GAS FREIGHT BOAT VILLE DE BRUXELLES AT GHENT WITH CARGO OF 180 TONS

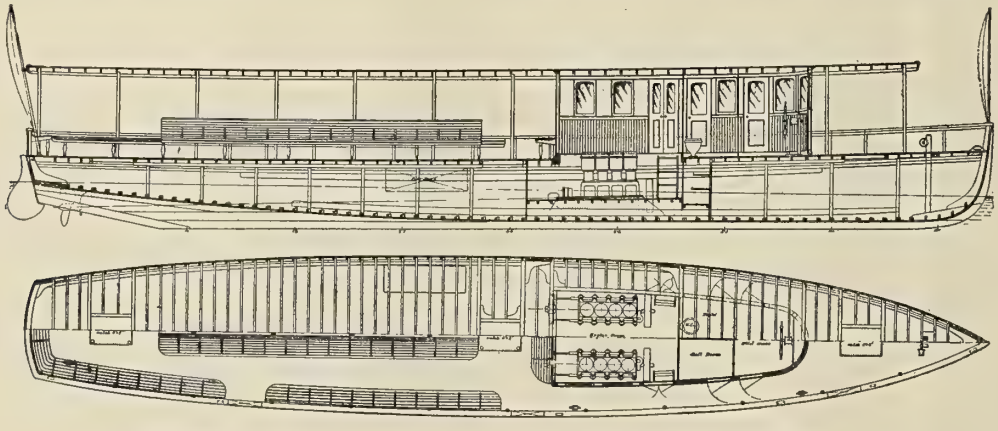
constructed, the only attention required, in addition to putting on small amounts of fuel, perhaps once an hour, is cleaning out the ashes once or, at most, twice a day. Then the producer can be closed up and left alone.

It is a great mistake to suppose that any kind of a producer and any kind of an engine will work successfully on board ship. A marine producer and a marine engine require flexibility (*i. e.*, slow speed, high speed and all intermediate speeds), while on shore, with the ordinary stationary type of producer-gas plant, power is usually absolutely steady, running throughout the day with a steady load. While the Wolverine Motor Company does not advocate the use of producer gas on boats requiring less than 36-horsepower, on account of the extra room required for the producer plant, as well as the added cost of the installation, the demand for larger units is steadily increasing, and the company is developing six-cylinder engines of 200 and 350 horsepower for operation with producer gas, a step which will tend to broaden the field for internal-combustion marine engines.

Passenger Boat for Cuban Waters to Operate on Alcohol Fuel

An interesting shallow-draft passenger motor boat, designed by Messrs. Cox & Stevens, New York, and constructed by William R. Osborn, Croton-on-Hudson, N. Y., has been built for passenger use in Cuban waters. The dimensions are: Length over all, 72 feet; beam, 12 feet; draft, loaded, 3 feet 6 inches.

The requirements presented to the designers were on the above approximate dimensions to produce a vessel that would have a seating capacity for seventy passengers and would carry the same on the draft given at a speed of 16 miles an hour in smooth water. To accomplish this result, it was necessary to reduce the weights as much as possible, and accordingly a light but substantial construction was adopted, the frames being of oak, most of them steamed, but a sufficient number being double-sawn frames, so as to produce the necessary rigidity of hull. The planking, bulwarks and main deck are of yellow pine, the fore-and-aft interior members are of Oregon pine in long lengths, and the awning deck of ½-inch tongue and groove white pine canvased.



SHALLOW DRAFT MOTOR BOAT TO BE RUN IN CUBAN WATERS ON ALCOHOL FUEL

The motive power consists of two 90-horsepower Craig motors, to be operated by alcohol instead of gasolene (petrol). These motors are located amidships, with an enclosing house arranged so as to afford ample ventilation. The fuel tanks are under the main deck aft, and are carefully designed to prevent all danger of leaks.

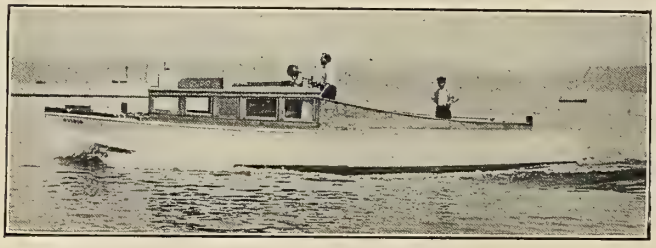
As the vessel was designed for day work only, no accommodations are provided, the house shown containing, in addition to the engine room enclosure, only the pilot house, toilet and mail room.

In preparing the lines for this craft, the designers adopted an easy running form, using the modified transom stern with an easy run, thus allowing a good flow of water to the propellers and a very clean entrance, associated with a considerable flare, so as to provide a dry boat when running in rough water. The rudder is overhung, and in order to make the boat hold her course well considerable deadwood is worked in between the propellers. This, however, is cut away aft, as shown, so as to make the vessel turn more easily.

The adoption of alcohol as fuel was made only after most thorough tests, and if the promised results are obtained it is more than likely that several other vessels of this same type, using alcohol as fuel, will be ordered.

A Work Boat for Mexican Waters

The Anglo-Mexican Petroleum Products Company has recently had built, from designs by Morris M. Whitaker, Nyack-on-Hudson, N. Y., two motor boats of fairly heavy construction, of the tunnel stern type, designed to carry a load of 2 tons in the cockpit on not over 20 inches draft. One of these



THE OVIDIO ON TRIAL

boats, named *Ovidio,* shown in the photograph, is now in service, and on a test obtained a speed of about 9¼ miles per hour in light condition. The photograph, which shows the boat under test, gives the boat the appearance of being slightly down by the head, due to the fact that she is light and the weight of her cargo in the cockpit is missing. The motive power consists of a four-cylinder, four-cycle Buffalo slow-speed motor, 5 inches by 6½ inches, turning a 26-inch three-blade Hyde propeller at a speed of about 450 revolutions per minute.

Each boat is 37 feet 6 inches long by 9 feet beam, and is equipped with a 100-gallon fuel tank and a 30-gallon fresh water tank. They are built in accordance with Government regulations, covering motor boats of the same class in the United States, with reference to fire extinguishers, lights, life preservers, etc., and are coppered for protection against the

toredo. Due to the necessity of carrying so much weight on such light draft, the form is very full, which accounts for the big bow wave shown in the photograph. The forward sections are well flared for seaworthiness, and the bottom amidships is flat with rounded bilges. The tunnel is long and circular in shape.

The keel and framing are of the best white oak, with two pairs of longitudinal stringers of yellow pine and with yellow pine clamp and oak rubbing strake. The cabin outside and the cockpit coaming are of oak. The cockpit flooring is 18 inches above the waterline, well braced to carry the load and supplied with scuppers at each corner to make it self-draining. The motor, after starting, is controlled entirely from the steering station, and the exhaust, which is water-cooled by turning part of the circulating water into it, is carried out through the stern. All outside metal work under water is of bronze and on deck of galvanized iron.

This boat is designed for the use of the oil company in carrying package freight for their stations, and is fitted with a cabin and galley for passenger service.

Kansas City has recently erected a municipal wharf, wharf house and machinery, which represent a thoroughly modern and complete equipment, as complete as found on any other river in the United States. One and one-quarter million dollars (£256,000) was subscribed by the citizens for its construction. The wharf is 50 feet wide by 525 feet long, constructed entirely of concreted timber, and supported on wooden piles driven to rock bottom. The concrete wharf house is adjoining, but is separate from the pier construction of the wharf, and is 40 feet wide and 305 feet long. It is supported on concrete walls which rest on wooden piles. An 8-foot gage track runs along the wharf; on which a 3-5 ton Brown hoist electric locomotive crane is operated.

3-TON BROWNHOIST ELECTRIC LOCOMOTIVE CRANE OPERATING ON WIDE GAGE TRACK ON THE MUNICIPAL WHARF AT KANSAS CITY, MO.

Freight Handling Equipment at Kansas City Municipal Wharf

Due to the rapidly increasing river traffic on the Mississippi and Ohio rivers and their tributaries, the principal terminal cities are building wharfs and installing modern loading and unloading systems to accommodate this growing traffic. For some time now boats have been plying back and forth between the East and West, Pittsburg on the Ohio River and Kansas City on the Missouri River being the terminals. The cargoes consist of both package and bulk freight, and barges have been built especially for this traffic. These barges are constructed with hatches somewhat similar to those on the Great Lakes freighters. The barges are made up of compartments, each being fireproof, so in case of fire starting in any one compartment it will be confined to that compartment alone.

Two feed wires strung beneath the floor of the dock, one on each side of the track, furnish the current to the crane. The illustration shows the current being supplied by the "plug-in" system before the feed wires beneath the floor were used, but it shows the slots in the floor through which the trolleys on the crane reach the feed wires, beneath.

The crane is equipped with a 35-foot boom and has a capacity of 2 tons at the extreme radius. The crane hoists the freight through the hatches in the barges, and, making a half-circle turn, deposits its load at the door of the wharf house. Within the wharf house the freight is transferred to the various points by means of an electric telpherage.

If at any time it is desired to unload bulk freight, such as coal, sand, etc., the crane can be equipped with a grab bucket for this work.

By the use of the crane the barges are unloaded in one-half the time required heretofore by a day-and-night shift of stevedores. The crane requires one operator, a ground man, and one or two men in the barge. The crane has a speed of one lift per minute—that is, it will hoist a load of two tons from the barge, turn and deposit it at the wharf house, and turn back to the barge, all in one minute.

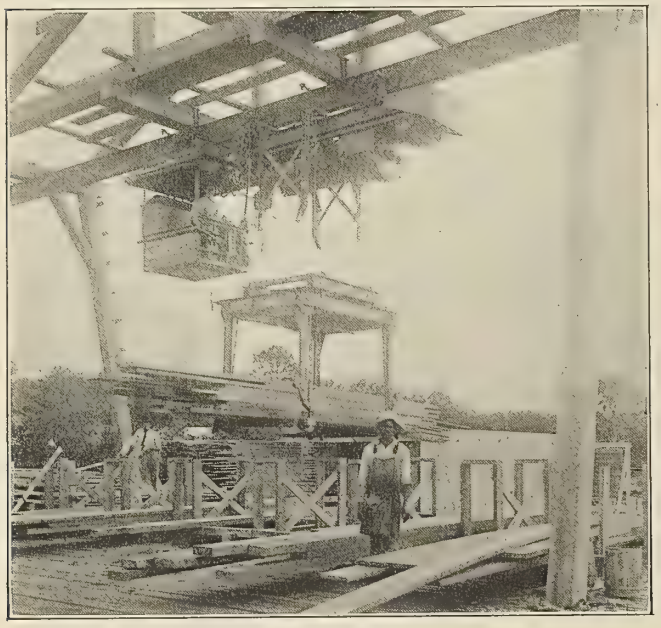
The different transportation companies plan to have a barge or two at each terminus of the line, loading or unloading while the steamers are in transit with the barges. When a steamer reaches the terminus with its barge, there is always

another one loaded and ready to be taken on the return trip. In this way the steamers are operated at their maximum efficiencies.

C. R. Mandigo, assistant engineer for the Board of Public Works, Kansas City, was in charge of the laying out of the system, and the crane was furnished by the Brown Hoisting Machinery Company, of Cleveland, Ohio.

Monorail System of Handling Lumber Installed by the West Bay Naval Stores and Lumber Company

The problem of handling lumber economically is one that confronts every lumberman. The old raised wooden tramway and lumber dolly method of handling lumber is rapidly becoming obsolete, and while the largest mills would hardly consider anything but the most modern and approved methods, even the smaller mills are beginning to realize the importance



CARRIAGE HOIST FOR HANDLING LUMBER

of meeting competition by equipping their mills with a monorail system to help reduce the operating expense.

The West Bay Naval Stores and Lumber Company have recently installed a monorail system in their plant at St. Andrew, Fla. The equipment consists of one two-motor traveling electric hoist and 1,200 feet of 15-inch I-beam, properly supported on "A" frames. The lumber is sorted into unit packages of about 1,500 feet each and is loaded directly on to barges.

The original intention of this company was to handle the lumber on push cars over elevated tramways. However, comparative figures showed conclusively that the monorail equipment would bring about a saving of $20 (£4.1) a day, which would pay for the difference in cost in a little over ninety days. These figures have since been proved to be correct.

This mill handles in the neighborhood of 40,000 feet of lumber a day, and the saving is effected not only in actual operation and maintenance, but when the mill is "down" all operating expense ceases, as there are no horses or mules to feed, nor are there constant repair charges to be considered.

The system illustrated was installed by Pawling & Harnischfeger Company, Milwaukee, Wis.

Naval Architects' Meeting

The twenty-first general meeting of the Society of Naval Architects and Marine Engineers will be held at the Engineering Societies' Building Thursday and Friday, Dec. 11 and 12. The Council will meet at three o'clock Wednesday, Dec. 10, in the Engineering Societies' Building, and proposals for membership should be mailed so as to reach the secretary on or before that date. The annual banquet will be held in the Astor Gallery of the Waldorf-Astoria at 7 P. M., Friday, Dec. 12.

A preliminary list of papers to be read at this meeting is given below:

"Relative Resistance of Some Models with Block Coefficient Constant and Other Coefficients Varied," by Naval Constructor D. W. Taylor, U. S. N., vice-president.

"Expansion and Contraction of Certain Dimensions and Their Effect on Resistance," by Prof. H. C. Sadler, member of Council.

"Experiments on the *Fulton;* Effect of Bilge Keels," by Prof. C. H. Peabody, member of Council.

"Structure of Vessels as Affected by Demand for Increased Safety," by Mr. William Gatewood, member.

"A Substitute for the Admiralty Formula," by Mr. E. A. Stevens, junior member.

"Diesel Engine as Regards Marine Propulsion," by Mr. John Reid, member.

"The Evolution of the Lightship," by Mr. George C. Cook.

"Construction and Operation of Western River Steamers," by Mr. R. C. Wilson.

"The Influence of National Policies on Ships' Design," by Capt. W. L. Rogers, U. S. N.

"Indicating and Its Relation to Scientific Designing of Engineers," by Mr. C. S. Linch, member.

"The Manufacture of Anchor Cable," by Assistant Naval Constructor J. E. Otterson, U. S. N., member.

"Strains in Hulls of Ships, Showing the Effects of Pitching and Rolling," by Mr. James E. Howard.

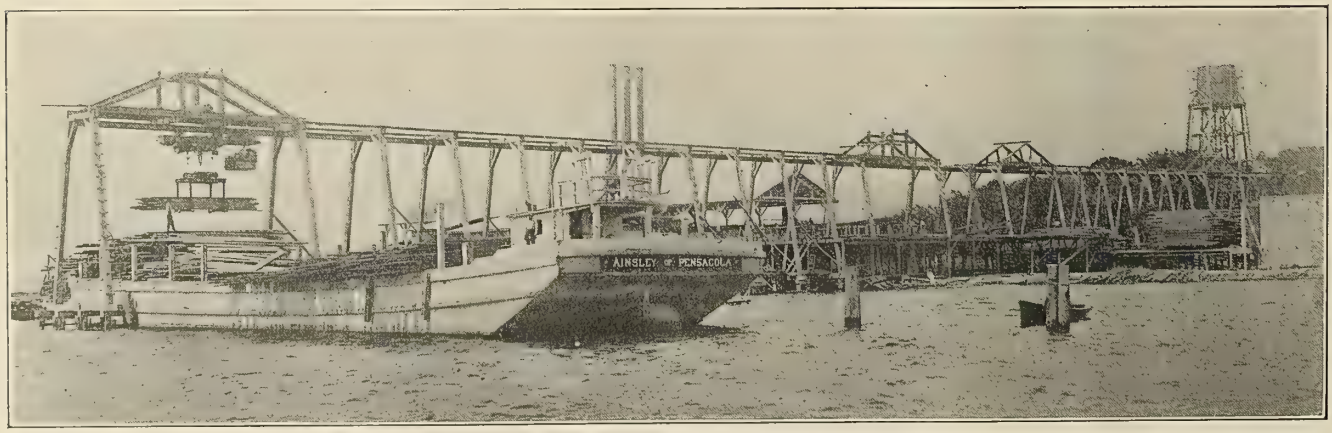
"Change of Shape of Recent Colliers," by Naval Constructor S. F. Smith, U. S. N., member.

"The Safety of Passenger Ships at Sea," by Mr. G. W. Dickie, vice-president.

"General Organization of a Navy Yard," by Capt. L. S. Van Duzer, U. S. N., associate member.

"Stability of Life Boats," by Prof. H. A. Everett, member.

"Notes on the Performance of S. S. Tyler," by Mr. E. H. Rigg, member.



MONORAIL RUNWAY SUPPORTED ON "A" FRAMES AND EQUIPPED WITH ELECTRIC TRAVELING HOISTS WITH SPECIALLY DESIGNED LUMBER CARRIAGES

Freight Burtoning at Marine Terminals

BY H. McL. HARDING*

At the port of Hamburg, the following is the latest practice for the width of quay-wall sheds, namely: "The modern sheds should be 200 feet in width, in order that the goods taken from *one* ship may be distributed *opposite* to it for further treatment."

The same conclusion, but extended in its scope, had already been deduced from a study of the great capacity obtained by high tiering by machinery.

Simplicity

By extending the principle to projecting pier sheds with *two* ships, one upon each opposite side of the pier, and for outbound as well as the inbound freight, and the width of shed not limited to 200 feet, as upon the Hamburg quays, but planned according to the length of the pier and the operating conditions, there is attained a still further simplifying of previous terminal layouts.

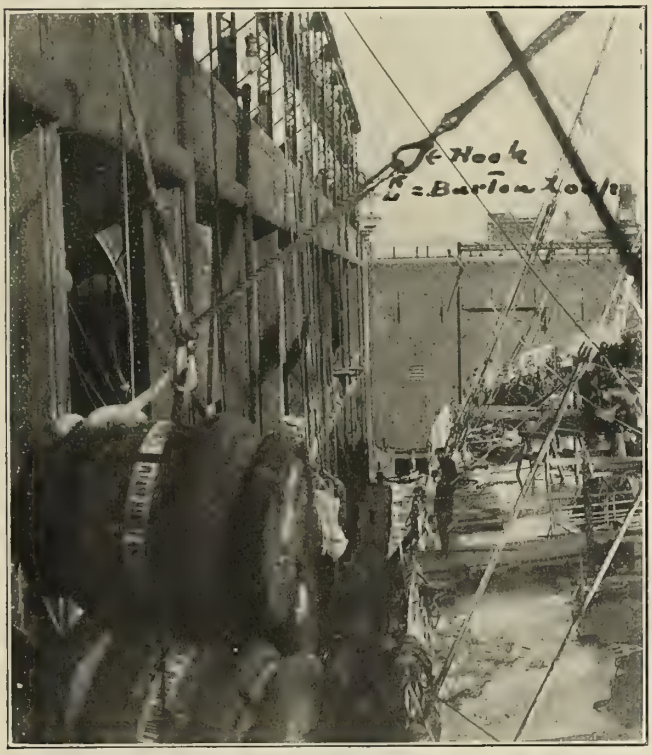


FIG. 1.—TO ONE OF THE FALL ROPES IS ATTACHED A LOOP FOR THE INSERTION OF THE HOOK OF THE OTHER ROPE. THIS IS CALLED THE "BURTON LOOP"

The practical result of this is that where gantry cranes are installed the longitudinal track loop from one end of the pier shed to the other can often be omitted, unless connection is to be made with remote warehouses. That portion of the pier or quay opposite the ship or ships is, with high tiering from movable tracks, made of size sufficient for all transshipment operations and temporary holding capacities. The long reaching gantry cranes serve the cross loops opposite the ships by direct "burtoning."

Burtoning consists in transferring the draft, or the weight of the draft, without stopping or lowering, from one hook or fall rope to another, as from the hook of one boom to the hook of another boom, or from the hook of a gantry crane to the hook of a carriage hoist.

*Consulting engineer, New York City.

Unit of Capacity

One unit of pier length would therefore be 400 to 600 feet, equal to the length of the larger freighters. The total length of the pier may be 1,000, 1,200, or 1,500 feet, or, in fact, any length divided into units corresponding to the present or future length of ships.

The length of the present larger freighters establishes this unit, the longitudinal, from 400 to 600 feet, and this can be increased at any time by adding more cross loops. There is, as usual, the utmost flexibility in all dimensions; that is, in length, width and height of the sheds.

The cross loops with the movable tracks are, in the latest designs, supplemented by intermediate transverse loops without movable tracks, extending across the pier from one side to the other for service between the ships or between barges, lighters or river craft on one side of a pier, and the outgoing and incoming ships on the other. These loops also can be adapted for transference between vessel and cars, especially when the cars are on a projecting pier, or the cars are to the rear of the sheds on quays. On quays the transverse loops can be extended to the rearward warehouses.

FIG. 2.—BY SLACKENING THE ROPE, A, THE WEIGHT OF THE DRAFT IS TRANSFERRED OR BURTONED TO THE ROPE, B, AND THE DRAFT IS LOWERED TO THE PIER FLOOR

Range of Cranes

By the long outreach of the gantry cranes all these loops can be served from hatchways by one or more gantry cranes. Goods from all the hatchways of a ship or other vessels can be mechanically assorted, distributed and tiered within this unit, or space of the movable and transverse track loops, opposite the ship, as well as from the hatchways of another steamship on the opposite side of the pier.

A few figures will demonstrate this. A pier may be 1,000 feet long and 300 feet wide. The space in the loops opposite

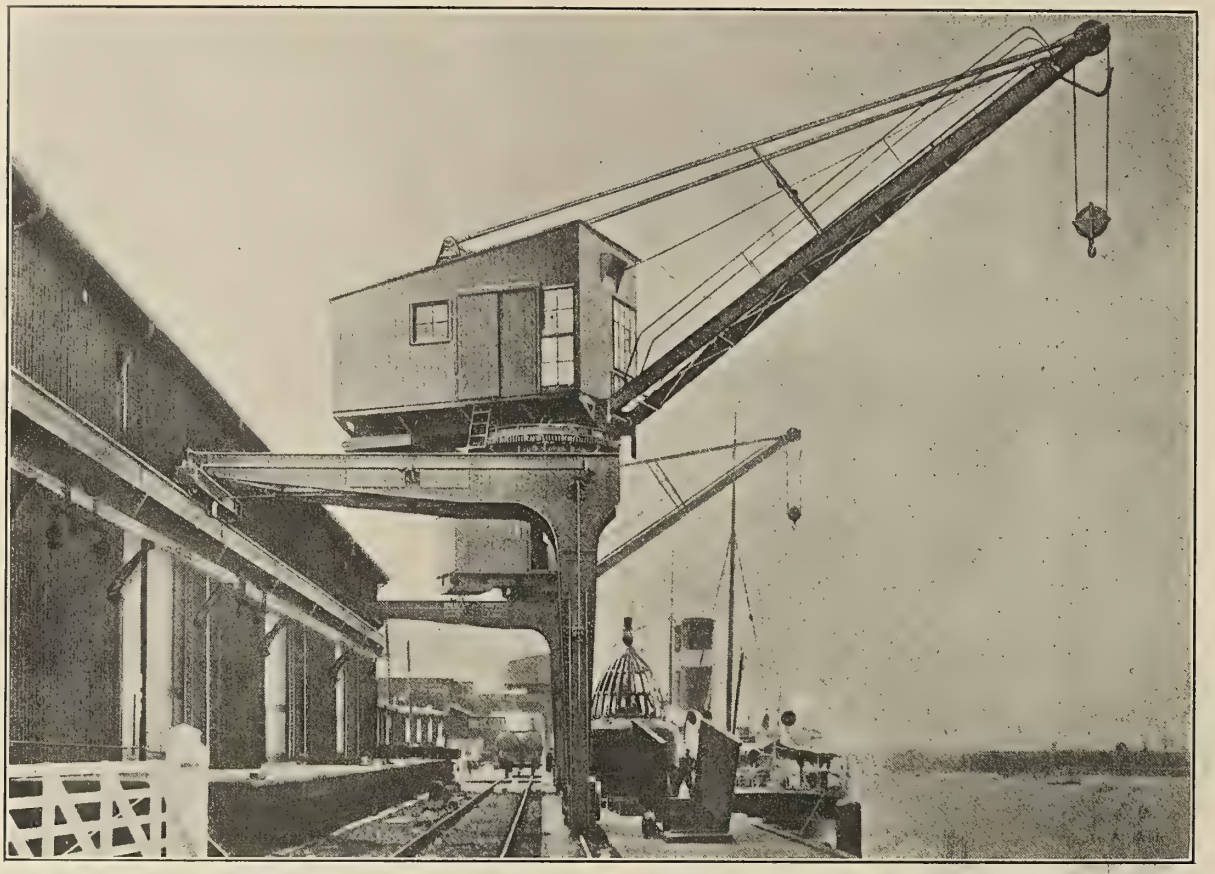


FIG. 3.—COMBINED RAILWAY AND STEAMSHIP TERMINAL EQUIPPED WITH ELECTRIC TRAVELING AND REVOLVING GANTRY CRANES OF THE HALF ARCH TYPE, QUAY SHEDS FOR TEMPORARY STORAGE OF MISCELLANEOUS FREIGHT AND RAILWAY TRACKS BETWEEN QUAY SHED AND THE QUAY WALL FOR HANDLING INBOUND AND OUTBOUND FREIGHT WHEN ASSORTING IS NOT REQUIRED

the ship, tiering on the average 20 feet high, with allowances for passageways, columns and free spaces, will give from 26,000 to 32,000 tons capacity. Low studded sheds also can be served, but the holding capacity is proportional to the height. It is a good plan to always make the first story of new sheds of ample height. One-story sheds are preferable for rapid freight movements.

As the usual average height of tiering by manual labor is 5 feet, this 400-foot loop-covered space, tiering 20 feet, is of itself equivalent to a pier over 1,400 feet in length

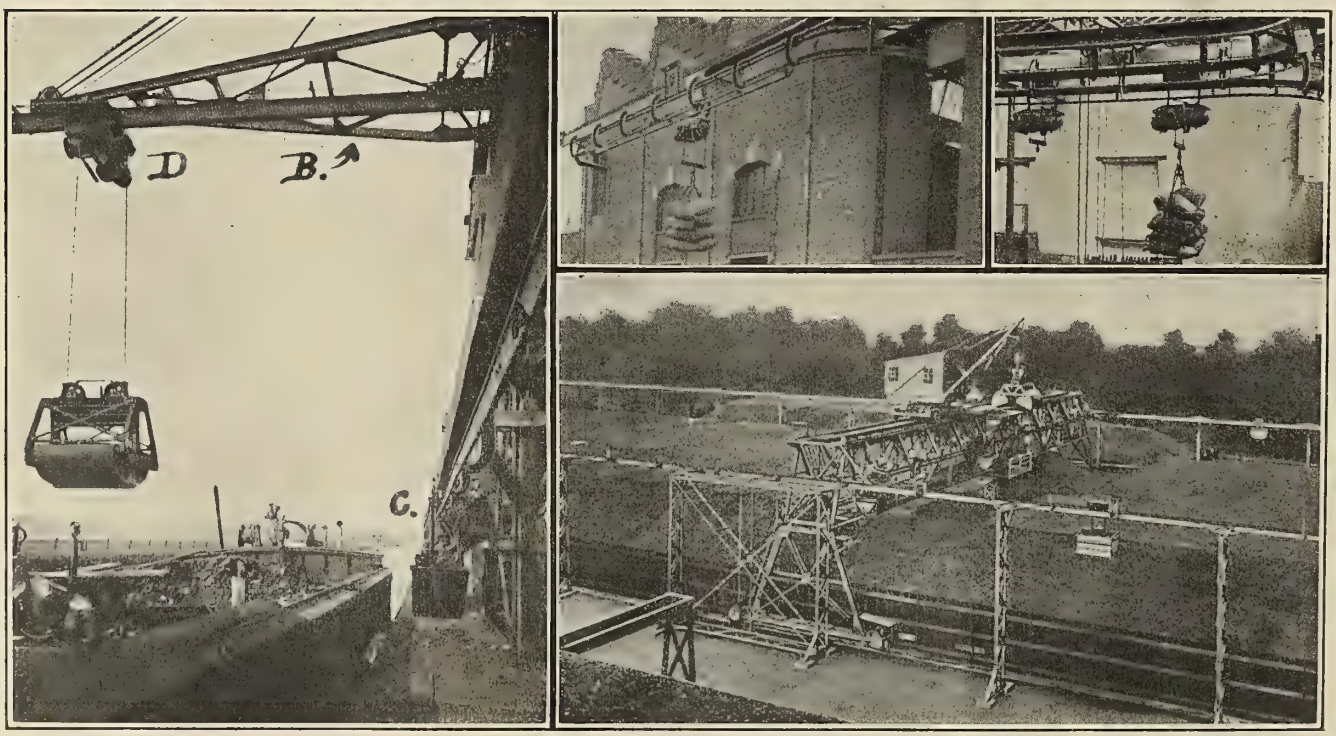


FIG. 4.—GERMAN FREIGHT HANDLING APPLIANCES AT MARINE TERMINALS

A is the burtoning track, *B* the overhead crane, *C* the carriage hoist, *D* the crane hoist. The upper views at the right show the carriage hoist, and tracks outside and inside the shed. The lower view shows a movable track bridge carrying a heavy gantry crane and hopper. The carriage buckets pass from the side fixed tracks to the cross movable tracks, serving all space in the yard.

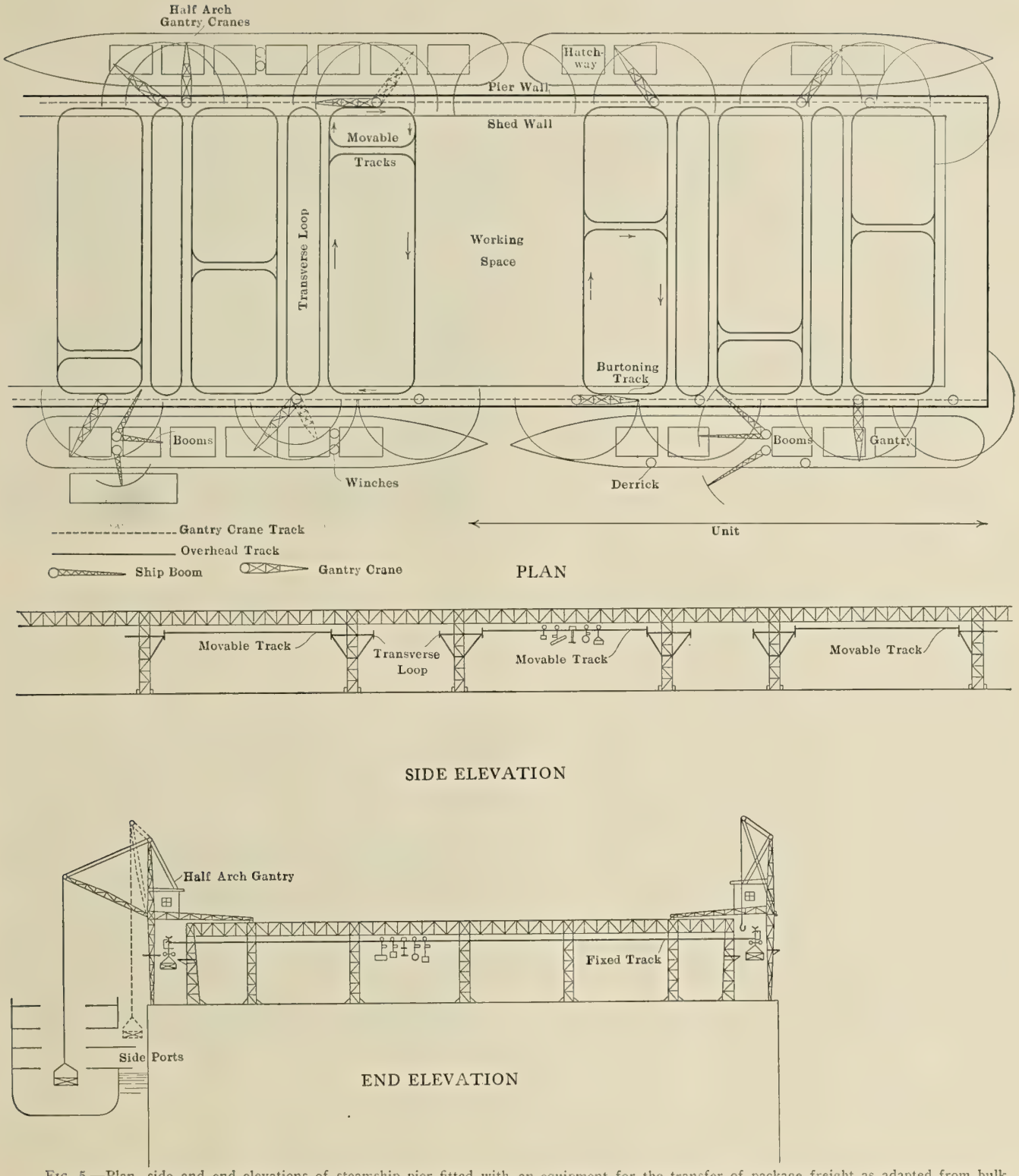


Fig. 5.—Plan, side and end elevations of steamship pier fitted with an equipment for the transfer of package freight as adapted from bulk material handling methods. With bulk material, such as ore or coal, the gantry cranes hoist and fill a hopper or reservoir from which the conveying buckets receive their loads. In the above plan, gantry cranes raise drafts of package freight which are burtoned to carriage hoists in trains of four, which constitute a reservoir equivalent to the bulk material hopper. As soon as the carriage hoists, constituting a train, have received their drafts and have started to convey and deposit the drafts, their place is filled by another train of hoists. The reverse movement is from the carriage hoists to the gantry crane, thence to the hold of the ship.

and 300 feet in width when the tiering is only five feet.

This first loop space includes only 400 feet of the 1,000 feet total length of the pier, 200 feet being permanently kept free for low tiering or for working areas. Another 400-foot length is for the second loop space. There are additional spaces at the sides of the pier not included.

This similar loop, also occupying 400 feet, will have an additional capacity of 26,000 to 32,000 tons, or another pier equivalent to 1,400 feet in length. The unoccupied working spaces represent more than one-fifth the total length of the 1,000-foot pier. Similar package freight is often tiered over 32 feet in height in pier sheds in New York harbor.

The total of 52,000 to 64,000 tons of package freight, or miscellaneous cargo, not including the working area, is in excess of the requirements for temporary freight holding for two ships. The basis of 60 cubic feet per ton, instead of the marine 40 cubic feet, was taken. Fifteen feet tiering would give three-quarters of the above capacity. By making the

width of the pier 200 feet instead of 300 feet, there would be storage for about 34,000 to 42,000 tons.

The Operations

The operations of discharging consist in having one to two gantry cranes lifting plainly marked drafts from each hatchway and burtoning to carriage hoists (traveling winches) suspended from the designated overhead loop. One draft of more than one mark may be divided among the four carriage hoists of one train for assorting before distribution. The tractor-man only travels around and around his own loop, there being no switches or cross tracks for him to open or close. Loading is a simpler operation than discharging, as without any assorting and distributing the full-weight loads are burtoned from the carriage hoists of the overhead loop tracks, which project just beyond the shed line, to the gantry cranes or ship's winch, and by them lowered directly into the hold. The movable tracks operated by the floor hook-man enable every cubic foot to be served.

The speed of transference is only limited by the number and capacity of gantry cranes, as the capacity of the carriage hoists, by adding to their number, can be kept in excess of that of the cranes. This layout and method of operation, having no switches, is of the utmost simplicity and rapidity. Burtoning from one boom to another, or from the boom to a side derrick or to a cargo hoist, is employed by about every freighter in New York harbor.

The Mechanism

The ship's stationary winches, derricks and burtoning booms can be used either separately or in conjunction with and supplementing the gantry cranes. The gantry cranes can be of the full arch, half-arch or roof type, or what is called the walking gantry crane, the latter being adapted to canal terminals.

The special object of this layout was to secure the greatest rapidity in loading and discharging and increased terminal holding capacity. By making one terminal equivalent in service to two, there is no small saving effected. The overhead tracks are fixed and movable. There are trains of four carriage hoists and the tractor. No new types of machinery are involved.

Loading and Discharging Capacity

Each gantry crane can transfer in its cycle about 200 tons per hour. With four hatches, two cranes at each hatch, there would be a capacity of about 1,600 tons per hour. Each train of carriage hoists in loading has for its average cycle nearly the same capacity.

In discharging, due to assorting and distributing, the capacity is less, depending upon the number of marks.

Conclusions

First. That on the projecting piers or quays opposite each ship or ships, there should be sufficient temporary shed-holding capacity for the incoming and outgoing cargoes with ample working floor space, it not being necessary to distribute outside this space.

Second. That this is practically and economically attained by mechanical high tiering from movable tracks.

Third. That it is possible to transfer continuously between vessel and vessel, vessel and cars, as well as between vessels, cars and shed, serving cubic space without rehandling, interference and congestion.

Fourth. That by the combination of the gantry crane or the ship's winch, or both, with overhead tracks, fixed and movable, equipped with trains or tractors and carriage hoists and by burtoning, there is attained the most important factor in terminal freight movements, namely, the greatest possible rapidity in discharging and loading the greatest tonnage, including mechanical assorting, distributing and tiering.

Light Draft Motor Boats for Foreign Waters

Two light draft motor work boats, built recently by the Welin Marine Equipment Company, Long Island City, N. Y., are shown in Figs. 1 and 2. The boat illustrated in Fig. 1 is of steel, 36 feet long, built for cargo purposes, and fitted with a

FIG. 1

16 horsepower Buffalo engine operating a single propeller in a tunnel at the stern. This boat is one of several built for service in Mexico. Fig. 2 shows a twin-screw 54-foot mail and passenger boat, fitted with two 24 horsepower Sterling engines,

FIG. 2

designed to give the boat a speed of about 15 miles per hour. This boat was built for service on the South American rivers.

Shallow Draft Steamers in India.—Some of the largest fleets of shallow draft steamers are to be found on the great rivers of India. The Irrawaddy, navigable from Bhamo down to the sea, with the numerous creeks in the vicinity of Rangoon, is particularly adapted to navigation by vessels of very restricted draft. At present Messrs. William Denny & Bros., Dumbarton, are constructing their 266th vessel for the Irrawaddy Flotilla Company, owners of a varied fleet, which carries on an enormous business on this river. Side-wheel, stern-wheel and single and twin-screw vessels have been employed as the conditions of trade required. The largest vessels are the mail steamers, of which the *P. S. India*, 310 feet by 46 feet by 11 feet, is a representative type.

McAndrew's Floating School

BY CAPTAIN C. A. McALLISTER*

"In closing my remarks on electricity, I want to impress upon you that, although it is not known definitely what electricity is, its effects are very well known, and there is no great mystery about it. You do not get something for nothing, as many beginners are apt to think. For all electrical energy generated and used, there is a still greater amount of mechanical energy exerted in its production. If the current comes from a battery, you have to produce it by the disintegration or wasting away of the zincs; if from a dynamo, it takes coal to produce it. The only free electricity we get is that from the clouds in the form of lightning, but no one has, as yet, found a method of utilizing currents from that source."

"What about Jersey lightning?" inquired O'Rourke.

"I suppose you refer to the New Jersey drink known as 'applejack,' and if that's the case, I haven't heard that that is free, either, but I understand its results are about as fatal as the lightning we get from the clouds. You probably know more about that than any of the others here."

CHAPTER XVI

Pipes and Valves

"The school will be in order," demanded McAndrew, as he entered "Highbrow Hall," it having been dubbed that by O'Rourke. The cause of this remark was a heated discussion which was being carried on by the four students as to whether the United States or Germany had the larger navy. Gus Schmidt and Nelson were maintaining that Germany was the more powerful, while Pierce and O'Rourke strenuously insisted that Uncle Sam was the superior on the water.

"Never mind about the navies of the world," said the instructor, "they're big enough to look after themselves—what you boys should be interested in is to be of some use to the merchant marine. I want to discuss this evening the subject

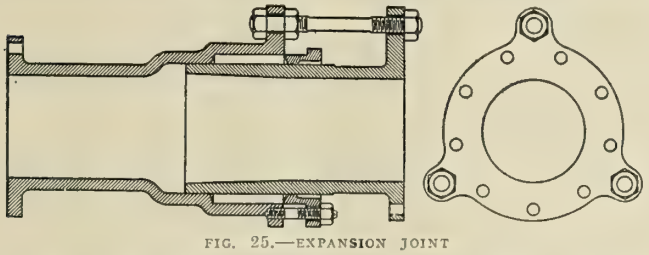


FIG. 25.—EXPANSION JOINT

of pipes and valves. We have dealt with boilers, engines, pumps, etc., and now we want to connect them up. This is, therefore, a very important matter, as much depends in the successful operation of marine machinery on having proper pipes to carry the steam and water and proper valves to control them. Piping on board ship can be divided into three general classes, *i. e.*, steam pipes, exhaust pipes and water pipes.

"The main steam pipe system is naturally of the greatest importance, as through this system the steam is passed from the boilers to the main engine.

"The material generally used for the main steam pipe is copper, on account of its great ductility, the ease with which it is worked and its freedom from corrosion. For sizes up to 10 and 12 inches in diameter it is made of seamless drawn material in order to avoid the brazed seam, which is liable to be the cause of leakages. As copper expands or increases in length when heated up to the temperature of the steam it carries, great care is exercised by designers to make arrangements for this expansion to be taken up without damaging the pipe or its flanges. One method of accomplishing this is by means of the ordinary 'slip joint,' as shown in this sketch.

"These, however, cause considerable work in order to have them properly packed, and have been known to pull apart and scald people who happened to be in the vicinity. The best method is to lay out the pipes so that there will be a number of large curves or bends in their length; the expansion then being taken up by the slight bending of the pipes. That is the reason you never see a large steam pipe run straight. As all pipes must be in such lengths as to get them in and out of the spaces they occupy for the purpose of making repairs, the sections must be securely bolted together. This, you may have noted, is accomplished by expanding the ends of the pipes into rings of cast iron or composition, called flanges, and after putting in some packing between the flanges, they are bolted up tightly together by means of a number of bolts of sizes to suit the diameter of the flanges. The making and keeping tight of these pipe joints is one of the most serious parts of an engineer's business. Various kinds of patented packings are used for making these so-called 'gaskets' for pipe joints; many of them are excellent, some are good, and others are not worth two hoots. You will each have to learn from your own experience which is the best material to use, but be sure and get the kind which keeps the tightest joint and lasts the longest."

"Which one is that?" inquired Nelson.

"Ask each packing agent who tries to sell you some, and you will find that he has the goods," was the reply. "Some night when you are compelled to work an extra watch to replace a blown-out joint over the top of a hot boiler, just make a record of your thoughts regarding that particular kind of packing, and when you get back in port show it to the agent whom you patronized."

"Wouldn't we have to write those thoughts on some asbestos paper?" inquired O'Rourke.

"I think you would," said McAndrew.

"Main steam pipes on some vessels carrying very high-pressure steam are made of seamless drawn steel, on account of its strength being greater than that of copper. The disadvantages of steel for piping are the difficulty in making easy bends and its liability to corrosion. The flanges on steel pipes are sometimes made solid with the pipe, and this makes the strongest job obtainable for a joint of this kind.

"Auxiliary steam piping is made of copper, brass, iron or steel, according to the class of work. Seamless drawn copper is about the best that can be used, while ordinary wrought iron piping with screwed joints is often used in the cheaper kinds of work.

"Exhaust piping for steam is made of copper or iron, and it only differs from steam piping in being made thinner, as it does not have to withstand so high a pressure.

"Speaking of iron piping, O'Rourke, did you ever see a piece of ⅞-inch pipe?"

"Lots of it," replied the ever-ready.

"Well, I'm glad to hear it," said McAndrew, "you are probably the only one living who has ever seen that size; as a matter of fact pipe manufacturers do not make any ⅞-inch pipe or any ⅝-inch pipe, either. Just why they don't I am unable to say, but the old-timers who originated pipes for use around gas works probably had good reasons for not doing so.

"Just jot this down in your memories: Pipe sizes are ⅛ inch, ¼ inch, ⅜ inch, ½ inch, ¾ inch, 1 inch, 1¼ inches, 1½ inches, 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½

* Engineer-in-Chief, U. S. Revenue Cutter Service.

inches, 5 inches, and above that in even inches. If any one ever tells you to go and get them a piece of 1⅛-inch pipe, or any other size which is not in the list I have given you, they are trying to run you. Just tell them that the storekeeper is all out of that particular size.

"If any one ever asks you the diameter of a 1-inch pipe, don't think that it is a similar question to 'What times does the 12 o'clock train leave?' for it is not. While the 12 o'clock train may leave at 12 o'clock, a 1-inch pipe is always 1.05 inches inside diameter; a ½-inch pipe is .62-inch inside diameter, or nearly ⅝ inch. Here, again, the old-time gas engineers got in their work; but if you don't like standard sizes you can go without them; they have come to stay, and you might as well try to buy cheese by the yard instead of by the pound as to get manufacturers to change these old-established standards.

"For high pressures, pipes are made 'extra heavy' and 'double extra heavy,' but the inside diameters are the same. the excess metal being put on the outside.

"Brass pipes are made of iron-pipe size, and are frequently used in small-sized steam and exhaust pipes. Iron and brass pipes are not bent so easily as copper pipes, hence to change direction in a pipe lead, or to reduce or increase sizes, various standard fittings are used. These, naturally, are made of what is known as 'malleable iron'—a cast iron which is not as brittle as ordinary cast iron. Hence if the lead of the pipe is to change at right angles, an elbow is used; if one pipe is to branch off at right angles to another pipe, a 'tee' is used; if two pipes are to be joined together for permanent use, a 'coupling' is used; if sections of piping are to be put up so that they can be taken down, 'unions' are used, and let me say right here that for marine work you can't use too many 'unions,' as they're mighty handy fittings; then there are 'plugs,' 'caps,' 'reducers,' and various other devices for the convenient installation of piping, all of them made with standard pipe threads.

"For water piping on board ship, copper is almost always used for pipes which handle salt water, although in some cases for bilge pipes, lead is used. Copper has the advantage of not being corroded by salt water, and as it can be bent easily it makes an ideal material for such purposes. For the feed pipes, seamless drawn brass is frequently used for the straight parts and copper pipe for the bends. For the fire main seamless drawn brass is the best material, but as this is very expensive it is seldom used. A very good substitute material for use as fire mains is wrought iron or steel lined with lead. The iron or steel furnishes ample strength to resist the pressure, and the lead lining prevents corrosion of the interior, providing always that no leaks develop through the lining."

"What do you mean by 'seamless drawn?'" asked one of the class.

"When pipes were first made they were rolled up into cylindrical form out of sheet metal, and the seam brazed in the case of copper and riveted for iron or steel. A joint of either kind is an element of weakness, and leaks frequently start from imperfections in the welding or brazing of the joint. Of late years the art of drawing metal pipes from a solid block or ingot over a mandrel has taken great strides, so that to-day it is possible to buy either steel or copper pipes of any size up to 12 inches and over in diameter which have been drawn solid, and consequently have no seams. Although at present the larger sizes of seamless pipe cost more than built-up pipes, the greater safety, due to the absence of joints, makes it advisable to use this pipe, especially for steam and water piping subjected to high pressures.

"In main feed pipes on board ship it is always necessary to make them in several lengths to facilitate their installation in crowded spaces, and to make them accessible for repairs. The location of flanges joining these sections together should be very carefully planned out in order to provide freedom of access in making new joints. When a leak occurs in a feed pipe joint it must be repaired very quickly, as boilers under steam won't run long without water. Every boiler is, of course, provided with both a main and an auxiliary feed connection, but no engineer ever feels very comfortable while even one of these pipe connections is out of order.

"Bilge pipes are sometimes made of lead, as I previously stated, but more often they are made of galvanized iron on account of the less cost. In connection with bilge piping it will be well to tell you something about the methods of getting water out of a ship's bilge, as every marine examiner will ask you something about that. The usual form of the question is, 'State how many means there are for getting water out of the bilges?' Perhaps you can answer it off-hand, O'Rourke."

"Sure," said that worthy. "Start the donkey pump, and if that doesn't do the trick put the firemen to work bailing it out with buckets."

"Starting the donkey pump would do for ordinary circumstances, but in an emergency, if you were put to work bailing out the bilges, I am afraid the ship would sink before you carried more than two or three bucketsful up the ladders; that is, if you didn't work any faster than you usually do.

"The usual method of pumping out bilges is by the independent bilge pump with which most ships are furnished. This pump can be connected to all compartments of the ship through the manifold, from which pipes lead to all bilges. You may have noticed that valve near the circulating pump which is always kept closed, and should be locked or tied shut. In a great emergency, such as the ship grounding or in collision, the main circulating pump can be connected so as to pump out the bilges, by closing the main injection valves, and opening this emergency or bilge injection valve, as it is termed. On most ships the auxiliary, or donkey pump, usually is connected to the bilge manifold, so that it may also be put to pumping out the bilges.

"Many ships are provided with what is known as a 'bilge ejector,' whereby a jet of steam starts and maintains a syphon effect which forces the bilge water up and overboard. Such a contrivance is too wasteful of steam, and consequently of fresh water, to be used very freely on vessels plying the ocean. If all these devices fail to keep the water in check, then the best thing you can do is to pack your grip and take to the boats."

"How about saying your prayers?" inquired O'Rourke.

"I don't think that would work in your case," retorted McAndrew.

"A very important point in connection with pumping out bilges is to see that the strainers are cleared. The bilges of all ships, as you may know, usually contain ashes, chunks of waste, shavings and other refuse, and they have been known to contain a fireman's undershirt or overalls. These things if drawn into the bilge suction pipes would soon choke them up and the pumps would be useless. Hence it is that the end of every pipe is fitted with some form of a perforated strainer to catch the refuse before it can get into the pipes. The ordinary form is known as the box strainer, which, as its name indicates, is shaped like a box, and has all its sides and its bottom perforated with three-eighths or one-half inch holes. The top of the box is made easily removable so that it can be cleaned out. Unless given attention frequently these strainers themselves become plugged up with dirt and refuse, and you young men will probably never appreciate the importance of keeping them cleaned out until you are called on some night while the ship is rolling and pitching in a gale of wind to dive down in bilge water up to your armpits for the purpose of digging bunches of waste and handfuls of ashes out of the strainer boxes. An old-time chief engineer in the navy conferred a lasting boon on seafaring men by inventing what is known as the 'Macomb strainer,' a device whereby the water is strained through a metal basket in a cast iron body with a removable top. By simply removing a clamp in the top of the strainer body the basket can be lifted out and emptied in two minutes. This in-

vention has saved much profanity on shipboard, and probably many ships.

"In line with a talk on piping, and incidentally with profanity-provoking devices, we might stop casually and consider the steam trap, a necessary evil fitted to all steam plants. The primary purpose of a steam trap is to separate the water from steam in the numerous drains with which all marine machinery must be fitted. This is accomplished, or, I might add, is tried to be accomplished, in two principal ways: one by the automatic filling and emptying of buckets floating in the water of condensation, and the other by difference of expansion in metals as affected by the variance in the temperatures of steam and water. There are about as many different styles of steam traps as there are applicants for an easy job, but there are not more than two or three of these styles fit to use on board ship. I hesitate to tell you which they are, as I am a little uncertain even about their efficiency at all times.

"Of equal importance to the piping on board ship are the valves which control the flow of steam and water through them. Most of the work of the engineer, while the vessel is under way, is devoted to the opening, closing and regulating of valves. Knowing how and when to perform these functions

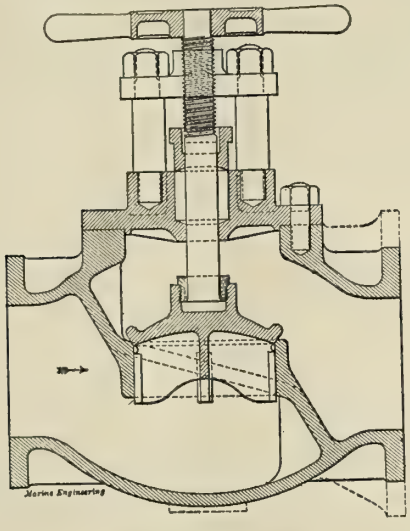


FIG. 26.—GLOBE VALVE

constitutes a large part of an engineer's practical knowledge. The efficient working of marine machinery is largely dependent upon the proper manipulation of valves, and on the other hand nine-tenths of all the trouble on board ship is occasioned by the wrong manipulation of these important details. With this introduction to the subject you can readily see that it will be well to pay a little attention to them. The valves used on shipboard may be divided into principal classes—angle and globe, stop and check, and gate valves, and various combinations of these types.

"A globe valve may be defined as one in which the steam, water, etc., enters and leaves the valve flowing in the same direction; an angle valve is one in which the steam, water, etc., enters the valve flowing in one direction and leaves the valve flowing in a direction usually at right angles to that in which it enters. Figs. 26 and 27 will illustrate these two types.

"A stop valve is one in which the disk is under absolute control of the hand wheel, and permits of flow through it in either direction.

"A check valve is one in which the stem is not connected with the disk, and permits of flow through it in only one direction. It can, however, be shut off by screwing down on the hand wheel.

"A gate valve is one in which the disk or gate is set at right angles to the direction of flow, and is at all times under control of the hand wheel. (See Fig. 28.)

"A cock is in reality a valve of the simplest design, wherein a conical plug is fitted in the body, and the flow of steam or water through it is regulated accordingly as the slit through the plug is placed in line with the direction of the flow or at right angles to it.

"Valves of all descriptions are made principally of the best quality of cast iron, as that is the cheapest and best adapted metal for the purpose. Composition is frequently used for

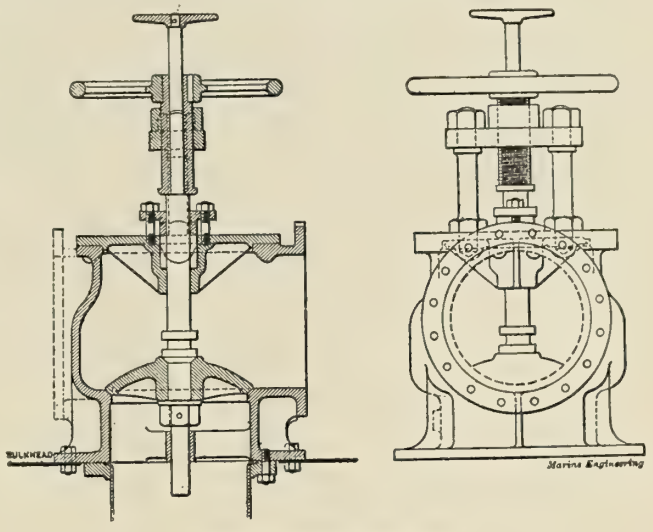


FIG. 27.—ANGLE STOP VALVE

small valves and for larger valves in high-class work, on account of its freedom from corrosion and greater strength. Its increased cost, however, precludes its extensive use.

"Cast steel is used to some extent for valves subjected to very high steam pressures, owing to its great tensile strength, but the difficulty of obtaining good castings, free from blow-

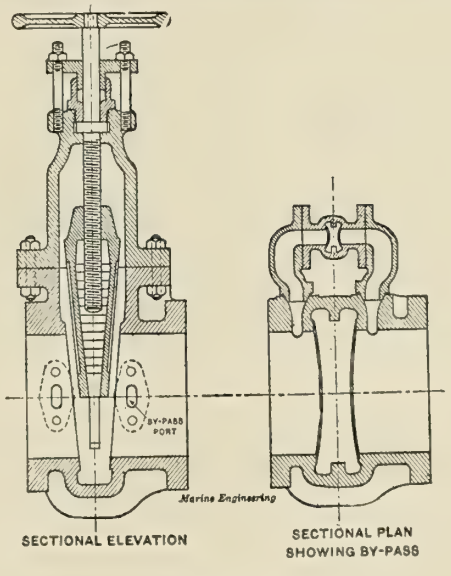


FIG. 28.—GATE VALVE

holes, limits its use to places where the greater strength is absolutely necessary.

"It is usual to have all cast iron valves 'brass mounted'; that is, to fit them with composition seats, disks, stems and stuffing-boxes, as these are the parts subjected to the greatest wear.

"Seats of valves become grooved by the constant flow of steam or water, and if not attended to regularly are bound to leak. Therefore one of the frequent duties of an engineer is to 'grind in' leaky valves, an operation which consists of removing the valve covers, covering the seats with a ground-

glass paste and revolving the disk in place until all grooves are removed. A valve reseating machine is a device for 'grinding in' valves mechanically while in place, the same as it would be done if the valve was removed and placed in a lathe. Such a device is a necessity in order to keep valves on a modern ship always tight."

"Chief, what is a reducing valve used for?" interrupted Pierce.

"Reducing valves are of comparatively recent use around steam plants, and have been made a necessity by the constantly increasing steam pressures now being used on board ship. While these high pressures are necessary for multiple-cylinder main engines to increase the economy of working, there are still certain auxiliaries on all ships which use lower steam pressures. Among these may be mentioned the ordinary reciprocating dynamo engines, the steering engine, the windlass engine, the bilge pumps, the heating apparatus, steam jackets, etc., and, in fact, wherever it is desirable to have low-pressure steam at a uniform pressure. These are devices whereby the high-pressure steam from the boilers may be reduced and delivered at almost any pressure desirable by regulating the reducer, after which, no matter how much the boiler pressure may fluctuate, a steady lower pressure is maintained for the auxiliaries."

"What is a relief valve, and why are they fitted on some pumps?" inquired Schmidt.

"A relief valve is simply a small safety valve," replied McAndrew. "I have already told you why these are useful on the main engines. On some pumps, and especially fire pumps, it frequently happens that a careless oiler or machinist will start the pump full speed, and if there are not sufficient openings of the stop valves along the fire mains the pressure might rupture the pipe. For that reason one or more relief safety valves, set to blow off at a safe pressure, are fitted in the fire main, usually in the engine room, where the escaping water can do no particular harm.

"I have already explained to you that a valve need only be opened a vertical distance equal to one-fourth its diameter, and I hope you will bear that fact in mind. Remember, also, what I told you about not opening a steam valve quickly. That, however, does not apply to water valves, as they should be opened as quickly as possible.

"In closing this lecture I will call your attention to the pipe covering. In general all pipes transmitting either steam or hot water should be covered with non-conducting material, such as hair-felt for low pressures, and magnesia or asbestos, or the various components of each for the higher temperatures. Escaping heat not only lowers the efficiency of any steam engine, but it adds to the discomfiture of the men who have to operate the machinery. If you ever have to do any pipe covering remember that you should not cover any of the joints, as it is often necessary to get at them quickly to make new joints, or to set up on them when they leak. All pipe covering should be encased in canvas, and it should be sewed on instead of being pasted, as some contractors like to do.

"We have about covered in a general way all parts of a marine installation, and from now on I will direct your attention to what may be termed specialties, and go into a number of subjects with which you will have to be familiar before getting your ticket."

(To be continued.)

FIRE LOSS AT SEA.—The loss of the Uranium Steamship Company's passenger and cargo steamer *Volturno*, resulting in the death of 132 persons, while one of the greatest sea tragedies in recent months, is but one of the many disasters which have occurred at sea on account of fire. According to reports by the Liverpool Underwriters' Association, during the first nine months of the present year, no less than 336 total and partial losses through fire at sea have been recorded

Motor Tank Ship Wotan

The arrival in New York on October 3 of the German-American Petroleum Company's new motor tank ship *Wotan* aroused considerable interest among naval architects and marine engineers. The *Wotan* is a large, splendidly-equipped tank ship. The dimensions are: Length, 404 feet; beam, 52 feet 3 inches; depth, 29 feet 6 inches; draft loaded, 23 feet; cargo capacity, 6,780 tons of oil, in addition to 900 tons of bunker oil and 100 tons of water. The motive power consists of a single six-cylinder, two-cycle Diesel engine of the Carels type, built by the Reiherstieg Schiffwerft und Maschinenfabrik

FIG. 1.—OIL TANK MOTOR SHIP WOTAN

of Hamburg, and designed to develop 2,900 indicated horsepower at 90 revolutions per minute. The voyage from Hamburg to New York was accomplished in fifteen and one-half days at an average speed of 8.1 knots. The engine averaged a speed of 79 revolutions per minute, developing 2,250 horsepower, and the fuel consumption figured out at 131 grams per indicated horsepower per hour. The fuel used was Roumanian gas oil of .86 specific gravity. The entire voyage was made without mishap, and after a cargo of oil was shipped at the Standard Oil Company's docks the vessel sailed again on October 9 for Flushing.

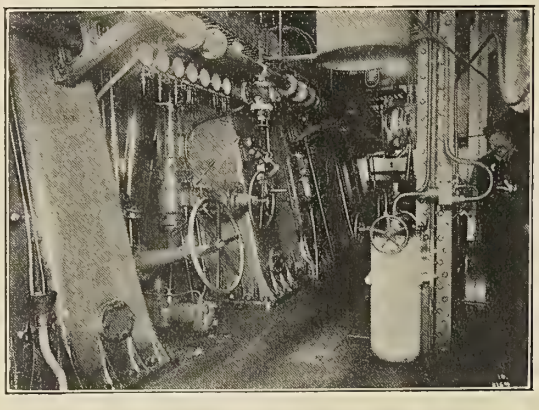


FIG. 2.—MANEUVERING GEAR IN ENGINE ROOM

The *Wotan's* engine is the largest single unit so far placed on board ship and conforms in design and arrangement to the usual type of marine Carels Diesel engine. The main air compressor is driven off the main engine. An auxiliary air compressor driven by a three-cylinder high-speed, four cycle Diesel motor is also provided. Two electric generators are installed, one driven by a two-cylinder, four-cycle oil motor, built by Messrs. Frericks, and the other by a steam engine. A two-furnace, oil-fired Scotch boiler, located on the main deck forward of the engine room, supplies steam at about 120 pounds' pressure for deck machinery, pumps, etc., while in port, and a small low-pressure boiler, coke-fired, provides steam for heating purposes when the large boiler is shut down.

Letters from Practical Marine Engineers

Incidents Relating to the Design, Care and Handling of Marine Engines, Boilers and Auxiliaries; Breakdown at Sea and Repairs

The Strength of Columns

U. S. Navy Column Tables Not Based Upon a Fundamental Misconception

Although no longer connected with the Bureau of Construction and Repair of the United States Navy, I cannot resist the suggestion of Mr. A. J. Murray that I reply to his very interesting article on columns appearing in the July and August numbers of INTERNATIONAL MARINE ENGINEERING, especially as I find it impossible to agree with some of Mr. Murray's conclusions, and in particular with his contention

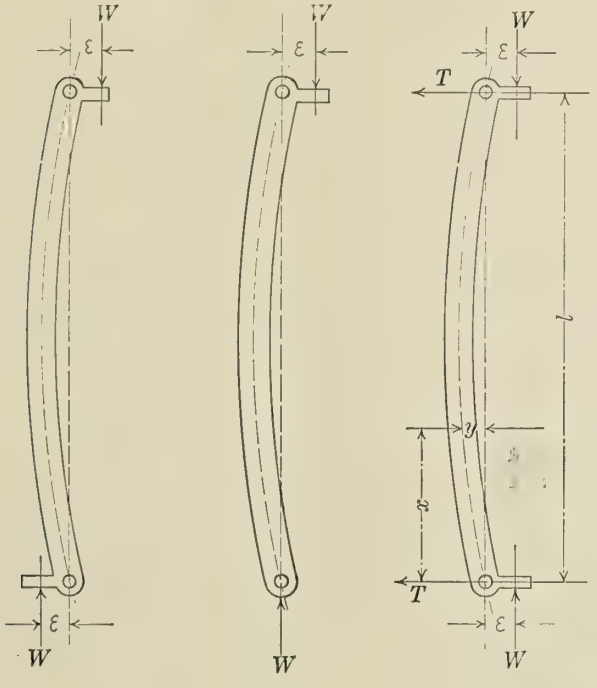


FIG. 1

that Moncrief's formula, from which the navy column tables were derived, is based upon a fundamental misconception.

Mr. Murray assumes that there is at each end of the column a horizontal reaction, the effect of which is to modify the equation of bending, introducing a factor not allowed for by Moncrief. In order to determine the correctness of Mr. Murray's deductions we will assume that the horizontal reactions exist just as Mr. Murray says they do, but will examine the consequent conditions of flexure in a somewhat different manner, following closely the method commonly used in analyzing the bending of beams.

It may be stated in the first place that if all the eccentricity in a column, due to non-central loading, accidentally imposed bending moments at the pins, non-uniformity of fabrication, etc., be summed up as single vertical eccentricities at the two ends, the eccentricities at the ends may be equal and acting on the same side of the axis, or equal and acting on opposite sides of the axis, or the eccentricity at one end may be zero, with, of course, an infinite variety of intermediate combinations. This is illustrated by Fig. 1.

It will be seen at once that the case of equal eccentricities, acting on the same side of the axis, produces the most severe bending in the column, and hence this condition only need be examined. Mr. Murray apparently assumes this condition, although some of his results do not agree with this assumption. For example, he derives a curve of bending moments that is not symmetrical with respect to the two ends, a result that is clearly impossible when the conditions at the two ends are assumed to be identical.

Now taking the reaction at either end as T, we have for the bending moment at any section

$$M_x = W\ (\epsilon + y) - T\ (l - x),$$

whence we can write

$$\frac{EId^2y}{dx^2} = W\ (\epsilon + y) - T\ (l - x).$$

On integrating we have

$$\frac{EIdy}{dx} = W\ (\epsilon + y)\ x - Tlx + \frac{Tx^2}{2} + C.$$

Now the bending moment must be a maximum at the middle of the length of the column, since the conditions at the two ends are alike, and hence $\frac{dy}{dx} = o$ when $x = \frac{l}{2}$, which enables us to evaluate the first constant of integration, giving

$$C = \frac{3Tl^2}{8} - \frac{Wl}{2}(\epsilon + y).$$

Substituting this in our equation we have

$$\frac{EIdy}{dx} = W\ (\epsilon + y)\ x - Tlx + \frac{Tx^2}{2} + \frac{3Tl^2}{8} - \frac{Wl}{2}(\epsilon + y)$$

On integrating again we have

$$EIy = \frac{W\ (\epsilon + y)\ x^2}{2} - \frac{Tlx^2}{2} + \frac{Tx^3}{6} + \frac{3Tl^2x}{8} - \frac{Wl}{2}(\epsilon + y)\ x + C'.$$

Now $x = o$ when $y = o$, enabling us to evaluate the second constant of integration, giving

$$C' = o.$$

Also, when $x = l$, $y = o$, so that we can reduce the equation to

$$\frac{W\epsilon l^2}{2} - \frac{Tl^3}{2} + \frac{Tl^3}{6} + \frac{3Tl^3}{8} - \frac{W\epsilon l^2}{2} = o,$$

or

$$-12T + 4T + 9T = o.$$

Whence we find that $T = o$.

In other words, the horizontal reactions at the ends, the neglect of which Mr. Murray considers as a fundamental misconception nullifying the value of the Navy Column Tables are, as a matter of fact, non-existent. Mr. Murray's equations are therefore themselves based upon a "fundamental misconception" which may be found at the very beginning of his article,

where he states that the necessary condition for equilibrium is that

$$T \times L = W \times \epsilon,$$

an assumption that neglects the resistance to bending of the column itself as a part of the static condition producing equilibrium.

Mr. Murray's contention that the formula from which the Navy Column Tables were derived is based upon a fundamental misconception is therefore not sustained, and the formulæ adduced by Mr. Murray are themselves based upon unsound mechanics.

Bridgeport, Conn. EARLE ANDERSON.

Salving a Sunken Car Float

Early in the morning of Sept. 22 the Pennsylvania Railroad car float No. 13, carrying eight freight cars, some of which were loaded, sank at her berth on the north side of pier 10 at the foot of Walnut street, Philadelphia, Pa. Three of the cars rolled off the float but the others remained on the float.

On the evening of Sept. 25 the Pennsylvania Railroad wrecking tug *Commissioner* arrived on the scene, and the next day began the work of raising the cars and the float. A diver went down and adjusted slings around the cars. On the 26th the first two cars were raised and placed upon another car float; on the 27th two more cars were raised, and by noon of the 30th all of the cars had been salved. The float, which is built of wood, came to the surface when the cars were removed from it and was towed by the wrecking tug to the Quigley & Dorp shipyard, Camden, N. J. Some of the cars and the float were considerably damaged, and the Bush Line steamer *West River* on the south side of pier 9 was held at her berth by the accident from the 22d to the 29th.

Fig. 1 shows the sunken float as it appeared at about half tide, and Fig. 2 shows one of the cars raised from the water and being swung onto another car float. The work of raising the eight cars and placing them on car floats occupied four and a half days.

Philadelphia, Pa. H. H. THAYER, JR.

FIG. 1.—SUNKEN CAR FLOAT

FIG. 2.—RAISING THE SUNKEN CARS

Total Breakdown of Float Feathering Gear of a Paddle Steamer

It sometimes happens that when a breakdown occurs no visible cause can be discovered to account for it. A case in point is the following, when the feathering gear of the paddle floats of a side-wheel steamer was completely wrecked. The paddle wheel had seven floats provided with the usual radius rods and driving arm. Each of the six radius rods was bent as indicated in the sketch, Fig. 1, and broken off at about the center, the diameter of the rods at the point of fracture being 2¼ inches. One of the paddle float brackets was also bent as shown in Fig. 2. The reason for this was due to the feathering eccentric sticking, but the cause of the breakdown is more difficult to show. It is certainly a most unusual occurrence and which cannot easily be accounted for. The superintendent of the line of steamers advanced the theory that the bolts connecting the driving rod to the feathering eccentric had either got sheared off or come loose and dropped out, allowing the driver to come adrift from the eccentric, hence causing the breakdown. Perhaps some other reader has come across a similar instance or could put forward a theory other than that already stated to account for this most unusual and inexplicable breakdown.

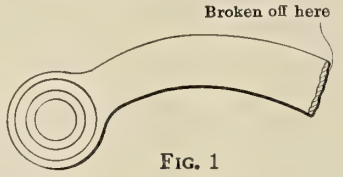


FIG. 1

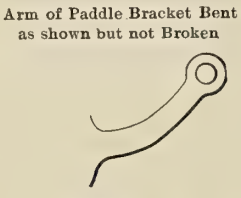


FIG. 2

Glasgow. "ISON."

LLOYD'S REGISTER SHIPBUILDING RETURNS.—Figures compiled by Lloyd's Register of Shipping, which only take into account vessels actually under construction, show that, excluding warships, 508 vessels of 1,987,254 gross tons were under construction in the United Kingdom at the close of the quarter ended Sept. 30. The tonnage now under construction is 16,000 tons less than that which was in hand at the end of the last quarter, but exceeds by about 140,000 tons the tonnage building in September, 1912.

Marine Articles in the Engineering Press

The Cunard Canadian Liner Andania.—The *Andania* is one of a pair of sister ships built by Messrs. Scotts' Shipbuilding & Engineering Company, Greenock, for the Canadian service of the Cunard Line. The vessel is 540 feet long, 64 feet beam and 46 feet depth with accommodations for 520 second class and 1,620 third class passengers. No first class accommodation is provided and the third class passengers are berthed in cabins instead of in the usual steerage quarters. Propulsion is by two sets of reciprocating engines, developing a total of 8,000 indicated horsepower. 1 illustration. 700 words.—*Engineering,* August 15.

The Imperial Ottoman Battleship Reshadieh.—The Imperial Ottoman battleship *Reshadieh,* launched September 3 from the Naval Construction Works of Messrs. Vickers, Ltd., at Barrow-in-Furness, is 525 feet long, 91 feet beam and has a displacement under normal conditions of 23,000 tons at a draft of 28 feet. The armor protection is very complete, consisting of 12-inch armor amidships, with the upper strakes reduced to 9 and 8 inches. The main armament consists of ten 13.5-inch guns mounted in pairs in five barbarettes on the centerline of the ship. The secondary armament includes sixteen 6-inch guns. Propulsion is by Parsons turbines of 31,000 shaft horsepower operating four shafts and supplied with steam by Babcock & Wilcox boilers. The designed speed is 21 knots. 850 words.—*Engineering,* August 29.

The Quadruple Screw Steamers Oosterdyk and Westerdyk.—These vessels are modern cargo steamers designed by Mr. H. van Helden and built by Messrs. Irving's Shipbuilding & Dry Docks Company, Ltd., West Hartlepool, for the Holland-America Company of Rotterdam. The dimensions are: Length, 470 feet; beam, 55 feet; depth, molded to shelter deck, 41 feet 7½ inches. The cargo loading and discharging gear is very complete and the accommodations for the officers and crew are fitted out with every possible improvement for the comfort of the *personnel* at sea, in accordance with the usual practice of the Holland-America Company. The machinery, built by Messrs. Richardsons, Westgarth & Company, Ltd., Hartlepool, consists of quardruple balanced four crank engines with cylinders 27½, 37¾, 55 and 84 inches diameter by 60 inches stroke, supplied with steam at 215 pounds pressure by six Scotch boilers. A feature of the engine is the fitting of a Contraflo condenser with its appropriate accessories. A brief description is given of the auxiliary machinery and equipment of the vessels. 6 illustrations. 900 words.—*Engineering,* August 29.

Typical Ships. No. II: A Harbor Tug.—The harbor tug described is one of a pair of steel side paddle tugs just delivered to the Admiralty by J. I. Thornycroft & Company, Ltd., of Southampton. The vessel is 145 feet in length between perpendiculars, 28 feet beam and 15 feet depth, equipped with two sets of diagonal compound condensing engines with cylinders 22 inches and 40 inches diameter by 60 inches stroke, giving a combined horsepower of 1,250, which drives the tug at a speed of about 12 knots. The boiler is placed aft of the engine room. That a side wheel tug should be classed as a "typical modern ship" seems fully justified in view of the service for which this tug is built. She is stationed at Sheerness, where there is a strong tide, and where there is only a small space to maneuver in with large vessels to handle. Obviously such a tug is not suitable for sea-going towing purposes, but, where it is necessary to handle large vessels in restricted quarters by pushing the huge vessels about, this type of power has been shown by experience superior to the screw type of tug. 3 illustrations. 2,500 words.—*The Engineer,* October 10.

Belt Coal Conveyor at Middlesbrough.—An installation made on the north side of the North-Eastern Railway Company's dock estate at Middlesbrough for conveying coal from railway cars to the hold of a ship consists of a coal carrying belt 42 inches broad and 310 feet long traveling up a long incline fixed at an angle of about 20 degrees to the ground level. It is fed at the shore end from a hopper of 30 tons capacity constructed in the embankment under the railway line. Means are provided for regulating the feeding of coal to the conveyor and for taking up the slack and reducing the slip in the conveyor. The conveyor delivers the coal to a tower on the dock, which is provided with a loading jib fitted with hinged connecting chutes down which the coal is delivered by gravity to the hatch of the vessel. Power is provided for raising and lowering the jib and moving it in a lateral direction 12 degrees each side of the centerline. When the jib is raised to a height too great for the coal to fall by gravity, an endless belt of steel plates or trays, running the whole length of the jib, driven by means of a friction clutch on the main shaft in the tower, delivers the coal to the ship's hold or bunker. The entire apparatus is under the control of an operator in the tower. The belt conveyor is driven by a Westinghouse shunt-wound direct current motor, run at a speed of 750 revolutions per minute with a voltage of 400. The installation, with the exception of electric motors, was constructed by Spencer & Company, Ltd., Engineers, Melksham, Wilts. 4 illustrations. 1,300 words.—*The Engineer,* September 26.

The Fottinger Transmitter.—An article giving complete data regarding a temporary plant installed at the Vulcan Works, Hamburg, for a long duration test of a 10,000-horsepower Föttinger transmitter, which was built with a view to fitting an installation of this power into a ship being built at the Vulcan Yard for service on the South Atlantic and through the Panama Canal. The main feature of the machine tested, which is fully illustrated, is the provision of a distinct water circuit for each of the two directions of rotation of the propeller shaft. The whole of the machine is mounted in one single casing, separated into two parts by a hollow partition. A very complete description of the machine is given and the method of operation is explained. After pointing out the main advantages of this type of transmission gear, the question of leakage losses is carefully dealt with. Other items of interest discussed are the governor and control gear and the methods of maneuvering. The maximum power recorded during the test of this plant was over 10,000 shaft horsepower. The reduction ratio corresponding to the highest transformer efficiency in all the tests was in the neighborhood of 1 to 5.3. The highest efficiency in almost every case was nearly 90 percent when going ahead and 70 percent when going astern. The excellent results obtained in these tests and the satisfactory condition of the transformer after the tests were made, led to the final ordering from the Vulcan Company of a machine of this type for a 22,000 ton steamer. 20 illustrations. 5,250 words.—*Engineering,* August 15.

The Cargo Ship France.—The vessel described is a combined sailing and oil engine-driven cargo boat built recently by the Société Anonyme des Chantiers et Ateliers de la Gironde, Bordeaux, for the Société des Navires Mixtes, of Rouen, for service between France and New Caledonia. She is a five-masted ship with 70,000 square feet sail area and is

fitted with two Schneider Carels-Diesel oil engines of 900 shaft horsepower designed for a speed of ten knots. The extreme length of the vessel is 430 feet; the beam, 55 feet 9 inches; the depth, 28 feet 2 inches; the draft, loaded, 23 feet 11 inches; the displacement, loaded, 10,700 tons; and the cargo carrying capacity, 6,500 tons. The ship is built of steel throughout and has a forecastle, a long deckhouse amidships and an after deckhouse. Her lower deck and holds are divided for the storage of goods. The double bottom, extending the whole length, is arranged for carrying water ballast. The deckhouse amidships has accommodations for six first class passengers. The after house is reserved for the ship's officers. The construction of the Diesel engines, fitted in the ship, is described in detail and data are given showing the results obtained on trial. The cylinders of the engines, which are of the four cylinder two cycle type, are 17.716 inches diameter with a stroke of 22.047 inches. The total weight of the engines, including shafting, flooring and auxiliary apparatus, works out at 158 pounds per shaft horsepower. The engines are uncoupled from the propeller shafts when the ship is under sail. During a six-hour trial on the testing bed at the works, each engine developed 925 shaft horsepower on a speed of 234 revolutions per minute. The fuel consumption on trial was .329 pound per indicated horsepower hour and .462 pound per shaft horsepower hour. 20 illustrations. 1,900 words.—*Engineering,* October 10.

The Large Canadian Lake Steamer James Carruthers.—The largest vessel of any description yet constructed in Canada is the bulk freighter *James Carruthers* built for the St. Lawrence and Chicago Steam Navigation Company, Ltd., of Toronto, by the Collingwood Shipbuilding Company of Collingwood, Ontario. The vessel is of the single deck type, designed for the transport of bulk cargoes of coal, ore and grain. The hull is 550 feet, 8 inches long over all, 58 feet molded beam and 31 feet molded depth. The deadweight capacity is 10,000 tons and load draft 19 feet. In accordance with the usual design of Great Lake freighters, no loading or discharging appliances are provided on board the ship. The cargo is handled through 31 hatchways spaced 12 feet apart center to center, each 38 feet wide and 9 feet long. Two complete collision bulkheads are fitted forward, forming a deep tank. The cargo hold is divided by screen bulkheads into six compartments and the double bottom by four watertight divisions into five compartments for water ballast. The remaining bulkheads are a cross bunker screen bulkhead between the engines and boilers, which are placed aft and a watertight after peak bulkhead. The upper deck stringer and plating between the hatch and the ship's sides is supported by longitudinal channel girders instead of transverse beams, which is a new feature on a vessel framed on the transverse system. The article describes the deck and auxiliary machinery in some detail. The propelling machinery, built by the Collingwood Shipbuilding Company, consists of a single set of triple expansion reciprocating engines with cylinders 24, 40 and 66 inches diameter by 24 inches stroke, capable of developing 2,400 indicated horsepower, which is designed to give the ship a speed of 11 miles per hour when loaded and 13 miles per hour in light condition. Steam is supplied by three Scotch boilers 15 feet in diameter and 12 feet long, designed for a working pressure of 185 pounds per square inch, and operated under Howden's system of forced draft. Construction of the vessel was begun in September, 1912, she was launched May 22, 1913, and went into commission in June. The article is well illustrated with excellent photographs of the vessel, showing the different stages of construction and launching. 11 illustrations. 1,700 words.—*The Shipbuilder,* October.

The Electric Motor Ship Tynemount.—The Electric motor ship *Tynemount,* built by Swan, Hunter & Wigham Richardson, Ltd., of Wallsend for the Electric Marine Propulsion Company, Ltd., recently underwent satisfactory trials, and is now ready for service on the canals and Great Lakes of North America. The boat is 250 feet long, 42 feet 6 inches beam, 19 feet molded depth She is of conventional lake design with the machinery aft. The prime movers are two six-cylinder Diesel engines of four cycle type each designed to develop 300 brake horsepower at a speed of 400 revolutions per minute. The cylinders are 12 inches diameter and 13½ inches stroke. They differ in no respect from the general type of engines made by Mirrlees, Bickerton & Day of Hazel Grove, near Stockport. Although the two engines are identical, the generators coupled to the engines differ in that one generator has six poles and the other eight poles, the periodicity of the current from the former being 20 per second, while that of the current from the latter is 26.6 cycles. Both generators have an output of 270 amperes per phase at 500 volts, which absorbs the full power of the engines, and they both run at the same speed; that is, 400 revolutions per minute. An exciter is coupled on the shaft of each alternator, and is designed to give an exciting current of 30 amperes, which can, when necessary for maneuvering purposes, be increased up to 50 amperes. Both alternators can be connected to a special type of induction motor patented by Messrs. Mavor & Coulson, which has two field windings entirely separate from each other, one embracing 30 poles and the other 40 poles. When these two windings are supplied with current at 20 and 26.6 periods respectively, they give the same synchronous speed of 80 revolutions per minute. Under these conditions, the motor will absorb the full power of both engines and drive the propeller to which its rotor is directly connected at a speed of 78 revolutions per minute, which corresponds to the fastest speed of the vessel. To obtain a slower speed, the connections are altered so that the alternator giving a 20-period current supplies the 40-pole winding of the motor, while the other alternator is disconnected and shut down. The result is that the synchronous speed of the motor driving the propeller is reduced to 60, and only about half the full power is developed. The direction of rotation of the motor is readily reversed by interchanging the connection of the two phases. This system overcomes the difficulty of attempting to run the two alternators in parallel. The whole handling of the ship can be carried out by means of two levers which are so interlocked that they are claimed to be practically "fool-proof." The controlling apparatus is explained in detail. 11 illustrations. 2,700 words.—*The Engineer,* October 10.

The Story of the Leyland Line.—At the end of the year 1912, the fleet of the Leyland line consisted of forty-five vessels of 275,300 tons, and there were under construction nine additional vessels of 52,275 tons. There are five passenger services maintained by the Leyland line, and on all of them cabin passengers only are carried. The various routes are from Liverpool to Boston; from London, Liverpool and Antwerp to New Orleans; from Liverpool to Jamaica, Mexico and Tampico; from Liverpool to St. Thomas, Colombia and the Isthmus of Panama, and from Liverpool to Barbadoes, Trinidad, Curacoa and intermediate places. This immense and varied service is the result of a continual growth of the line since its inception in the fifties of the last century. Mr. Bibby, of the well-known Liverpool shipping firm, established the line with a service to the Mediterranean. From this beginning the growth of the line, with its many alliances with other steamship companies at the various ports in the North Atlantic trade, is traced in an interesting manner by the author of the article. Reference is also made to the famous shipyards in which the vessels of the fleet were built, and particularly to the Harland & Wolf shipyard of Belfast, which was founded soon after the Bibby line was established and from which many Leyland line vessels were launched.—2,600 words.—*The Marine Engineer and Naval Architect,* October.

ENGINEERING SPECIALTIES

New Type of Condensing Turbine

Two main objects were sought in the design of the latest type of condensing turbine, manufactured by the Terry Steam Turbine Company, Hartford, Conn., namely, an economy approaching that of the larger units used in power installations and the prevention of air leakage into the condenser. In the

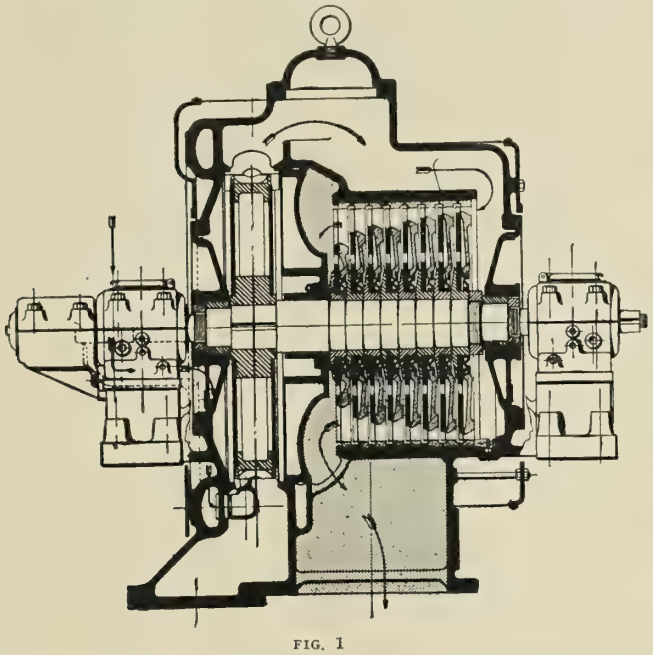


FIG. 1

new turbine the only gland exposed to vacuum has been shifted from the end of the casing to the middle, where it is exposed on one side to vacuum and on the other to steam at just above atmospheric pressure, thus making a leakage of air through this gland a physical impossibility. With this arrangement packing, or other devices, are unnecessary to keep the air out of the turbine.

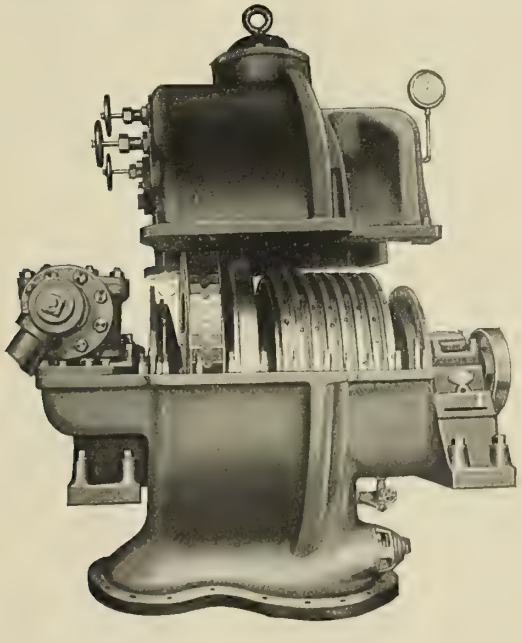


FIG. 2

The machine consists essentially of a regular Terry multi-velocity wheel as the high-pressure element, and a low-pressure end consisting of several multi-pressure impulse elements. The main feature distinguishing the arrangement of this low-pressure element from that used in some other types lies in the fact that it has been turned end for end, receiving steam at the end farthest from the high-pressure element and exhausting into the condenser connection at the center of the turbine. By this simple device of reversing the flow of steam and thus protecting the vacuum gland the old trouble of air leakage has been eliminated.

This turbine has the regular Terry characteristics, including a casing split on the axial plane, permitting examination of the runner without disturbing either steam or exhaust connections. It has the Terry indestructible high-pressure element which permits starting up the turbine from cold, even though a large quantity of water is thus thrown through the blades. This, the manufacturers claim, is done regularly without any danger from water hammer or any apprehension as to stripping of blades.

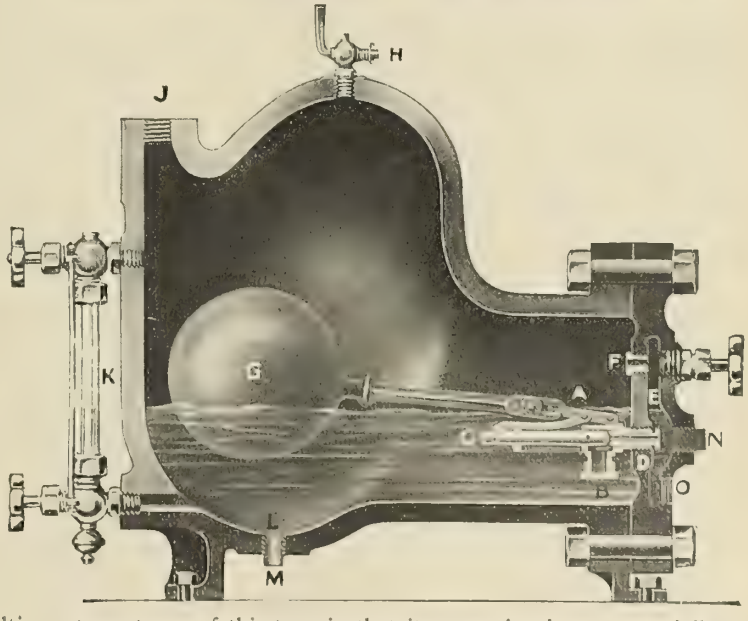
The stationary buckets in the low-pressure end are placed on annular rings, from which they may be removed in blocks as necessary. These rings are not fastened to the casing, but are bolted together and remain with the runner when the casing is removed, as can be seen in Fig. 2. They are held by friction to the casing when the upper half is drawn down tight to the lower half, and hence always retain their position when the turbine is running. This arrangement makes it very simple to examine all parts with a minimum of trouble.

The method of swinging the casing from the bearing blocks instead of from the base makes it always concentric with the runner. Expansion is radial and all clearances are maintained practically the same when the turbine is running as when it is cold. The side of the bearing in the pillow block is cylindrical. This is bored at the same time as the casing and from the same center, so that the axis of the runner cannot get out of line with the axis of the casing.

This new design of turbine is being applied to three principal uses—driving electric generators, blowers and centrifugal pumps; and up to date more than 300 Terry turbines have been installed in the United States and British navies for these purposes.

American Ideal Steam Trap

The American "Ideal" steam trap, manufactured by the American Steam Gauge & Valve Manufacturing Company, Boston, Mass., is of the ball-float type, but differs from other



steam traps of this type in that its operation is not materially affected by the motion of the ship. The construction is such that the trap may tilt to an angle of 35 degrees either way without affecting its operation. A horizontal valve guided true to its seat by two bearings is fitted with an adjustable seat

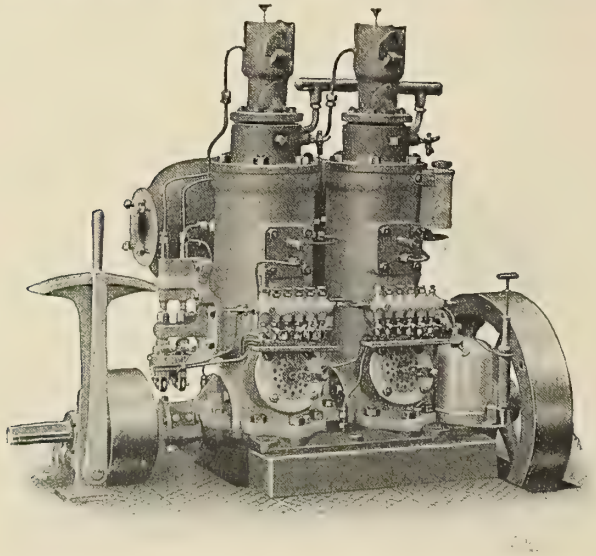
which can be regulated to give the valve a sufficient amount of water seal so that the valve will not be exposed to the steam at any angle of the ship. This is accomplished by the use of a specially designed shell large enough to maintain enough water in the trap to keep the valve sealed at all angles, and by the use of a heavy float which is not so easily affected by motion as a lighter float. This construction, it is claimed, overcomes the faults in other types of steam traps, whose successful operation depends almost wholly upon being in a horizontal position at all times, on account of the use of centrally and vertically guided valves or balance weights.

Practically all steam traps are constructed with a system of leverage which determines the capacity of the trap and the weight of the float which can be used to operate the valve. Where the leverage is insufficient, pilot valves and balance weights are used to aid in operating the valve proper. Such conditions, however, are eliminated in the American "Ideal" trap on account of a specially designed system of leverage which is exceptionally powerful, and which with the use of heavy floats makes possible the construction of a steam trap of great capacity. There is an emergency by-pass in the cover which does not affect the water seal, and also a water gage which is the "watchman" for all steam traps.

The actual capacity of any steam trap is obviously limited to the size of the opening in the valve seat. The American "Ideal" traps have standard size orifices in the valve seats equal to the pipe size connections, therefore giving assurance that the valve is large enough to handle all the condensation coming to it through the inlet pipe. By specifying the size of orifice in the valve seat and the maximum pressure under which the trap must operate, the manufacturers claim that all guesswork in determining the proper size of trap is eliminated, as the American "Ideal" trap is built to meet these specifications.

The "Original" Crude Oil Semi-Diesel Motor

The "Original" motor, manufactured by Bergsunds Mek., Verkstads A. B., Stockholm, is a semi-Diesel engine working on the two-cycle principle, but it differs in many respects from the numerous semi-Diesel engines at present on the market. In the first place, there is no hot bulb for ignition. In place of



this there is a separate water-cooled combustion chamber in which there is a nickel steel grid plate set at an angle to atomize the fuel. This plate is so arranged that it can be easily removed simply by taking out two small screws which connect it to the top cover plate. The fuel is spread on to the grid in a circle, an arrangement which, combined with the angle at which the grid is set, results, it is claimed, in the immediate vaporization or combustion of the heavy oil. It is claimed that there is no carbon deposit, and as freedom from carbon means perfect combustion and low fuel consumption the economy of the engine is apparent.

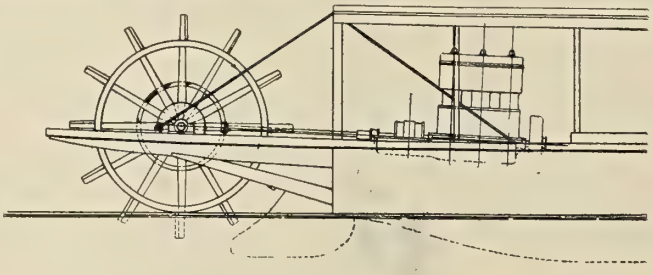
To start the engine, the grid plate described above is heated through contact with the top cover plate by a blow lamp, which is extinguished after the engine is started. The heat of combustion, it is claimed, always keeps the plates at the required temperature whether the engine is running with a light or full load. On account of this patent ignition the makers find it unnecessary to fit a water drip, and a troublesome accessory is thus entirely dispensed with.

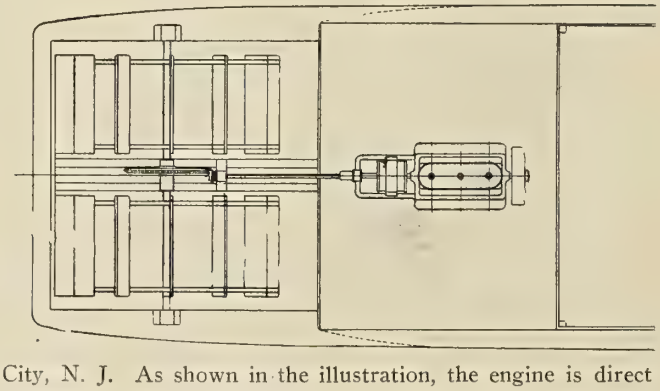
The "Original" motor is fitted throughout with forced lubrication to all parts, including the gudgeon pin bearings, and the amount of oil supplied is determined by the speed of the engine. Ignition is effected not on the hit-and-miss principle, but by a variable fuel supply, which, it is claimed, insures an economic use of the fuel, as the amount of fuel used is supplied strictly in accordance with the load on the engine. This method of governing also allows the engine to be run light indefinitely without the use of a blow lamp. Crank case compression is maintained by a patent collar, which works in a groove and is a tight fit on the shaft.

These motors are constructed in sizes from 5 to 300 brake-horsepower, with from one to four cylinders. The smaller sizes are furnished with mechanical reversing gear and the larger sizes are directly reversible by compressed air. The sole representatives for the manufacturers of these engines for the United Kingdom and China are Messrs. R. Wilson & Sons, Bank Chambers, Laygate Circus, South Shields.

Stern Wheel Motor Drive

A novel method of driving a paddle-wheel on a stern-wheel, shallow-draft boat by a gasolene (petrol) engine has been devised by the Standard Motor Construction Company, Jersey



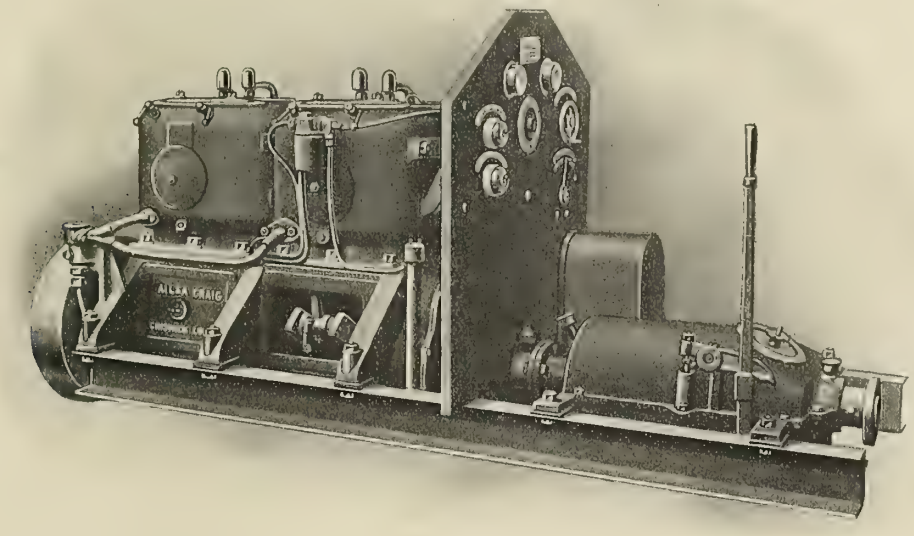


City, N. J. As shown in the illustration, the engine is direct connected to the wheel shaft by bevel gears, thus eliminating belts, cross shafts, etc. The engine can be placed in a fore-and-aft position on the center line of the boat, and, by a proper selection of gears, the most advantageous speeds of both engine and wheel can be obtained. This scheme is also commended by the simplicity and cheapness of its construction.

Ailsa Craig Marine Motors

The illustration shows a view of the port side of a 35-horsepower Ailsa Craig marine motor, manufactured by the Ailsa Craig Motor Company, Ltd., Chiswick, London, W. This is a four-cylinder, four-cycle engine, with cylinders 5 inches diameter and 5½ inches stroke, which, at from 700 to 950 revolutions per minute, develops from 30 to 35 brake horsepower, the fuel consumption being about three-quarter pint per horsepower per hour.

One of the most distinctive features in the design of the Ailsa Craig motors is the offset cylinder, which is set slightly in advance of the crank shaft, so that at the moment of maximum effort of the working stroke the connecting rod is practically vertical and parallel with the sides of the cylinder, giving



a direct thrust from the piston to the crank shaft without side thrust on the cylinder walls. A mechanical advantage is also gained at the end of the compression stroke, and owing to the piston speed being reduced when passing the dead center the exhaust gases have a longer time in which to escape than is possible in the ordinary engine. These special features of design result, it is claimed, in a gain in power and flexibility, besides insuring a remarkably smooth and silent-running engine. The motors can be operated on gasoline (petrol) or kerosene (paraffin), and the vaporizers are arranged so that the heat can be regulated to give the best results with fuel up to 150 degrees flash point.

The material used in the construction of these motors is of high grade throughout; the cylinders are of fine-grain hard iron cast integral with water jackets, which are exceptionally large and extend completely around the cylinders and valve pockets. The crank shafts are forged from solid high tensile steel billets and machined all over. The pins are ground true to 1/1000 inch. The valves are interchangeable and mechanically operated from a single cam shaft. The valve plungers, guides and springs are entirely inclosed in a metal casing, completely protecting them from dampness or mechanical damage. Oil for lubrication is pumped under pressure direct to every bearing, passing up the connecting rods to the gudgeon pins and ignition is by a high-tension magneto, direct driven.

Growth of Traffic on the Rhine.—According to the annual report of the German Rhine Navigation Commission for the year 1912, the total traffic on the German Rhine for 1912 was 61,189,316 metric tons of freight, or 6,967,164 tons more than in 1911. The percentage of increase was 13 and was the highest on record and very likely will never be equaled again. The growth of Rhine traffic is attributed to a general increase of business in 1912, but is more especially due to the improvements made in the river channel during 1911 and previous years, which has made the stream navigable as far as Kehl at practically all seasons of the year and permits of the use of deeper draft vessels. It is a matter of interest that the freight steamers and barges on the Rhine are largely constructed from American plates.

Obituary

John V. van Santvoord, one of the principal owners of the Hudson River Day Line, New York, died suddenly at Lake Mohonk on Sept. 26. Mr. van Santvoord was a son of the late Commodore Cornelius, who established the Hudson River Day Line, and he was also a grandson of the man who operated the first passenger-carrying line on the Hudson, known as the "Swift and Sure Line."

William Cary Selden, consulting engineer for the Clyde and Mallory Steamship lines, died at his home in Brooklyn on Sept. 24, aged eighty-one years. Mr. Selden entered the navy in 1857 and retired in 1868 with the rank of first assistant engineer. Mr. Selden was recognized as an expert in marine engineering. For many years he was designer of steam vessels and, until 1912, was the active superintending engineer of the Clyde and the Mallory lines.

Dr. Rudolph Diesel, inventor of the internal combustion engine, which bears his name, disappeared from an English Channel steamer Sept. 29 while on his way from Antwerp to Harwich to attend a meeting of the Diesel Company in London. As far as can be ascertained, Dr. Diesel fell overboard from the steamer and was drowned. Rudolph Diesel was born in Paris in 1858, and was educated in Augsburg, Germany, and at the Polyclinic College, Munich.

Personal

B. F. Davis was recently promoted to the position of chief engineer on the steamship *Olivette*. This promotion is well deserved, as Mr. Davis has served faithfully in all grades in the engine room on board ship, starting as an oiler on the very same ship of which he is now chief engineer. Mr. Davis also previously had a thorough training on the technical side of engineering in the old schoolship *Enterprise*.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., of INTERNATIONAL MARINE ENGINEERING, published monthly at New York, N. Y., required by the Act of August 24, 1912.

Editor, H. H. Brown; managing editor, H. L. Aldrich; business manager, H. L. Aldrich; Publisher, Aldrich Publishing Company, all of 17 Battery Place, New York.

Owners, H. L. Aldrich and M. G. Aldrich, both of 17 Battery Place, New York.

Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages, or other securities, A. I. Aldrich, Manville, R. I.; J. W. Reno, New York, N. Y.; Geo. Slate, Summit, N. J.; E. L. Sumner, Flushing, N. Y.

H. L. ALDRICH.
President and Treasurer Aldrich Publishing Company.

Sworn to and subscribed before me this 13th day of September, 1913.
O. M. PICKRUHL, Notary Public.
(My commission expires March 30, 1915.)

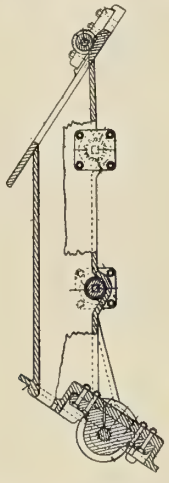
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents compiled by Delbert H. Decker, Esq., registered patent attorney, Loan & Trust Building, Washington, D. C.

1,067,872. SHIP'S HAWSE-PIPE. ALBERT HAMILTON, RICHARD HAMILTON, AND ALBERT HAMILTON, JR., OF CARDIFF, WALES.

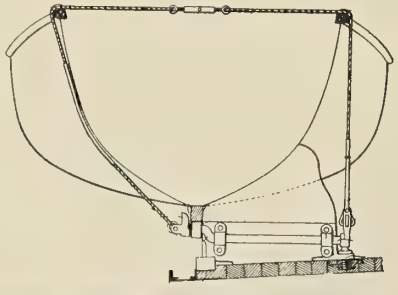
Claim 1.—In a ship's hawse-pipe, flanged bosses protuding inwardly through flanged lateral holes within the length of said hawse-pipe, a



transverse spindle journaled in said flanged bosses and a transverse roller mounted on said spindle. Four claims.

1,071,765. DEVICE FOR SECURING AND RELEASING LIFEBOATS. ANDREAS P. LUNDIN, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO ASTOR TRUST COMPANY, TRUSTEE, A CORPORATION OF NEW YORK.

Claim 2.—In devices for securing and releasing lifeboats, the combination with a cradle for the inboard side of such boat, a chocking block



for the outboard side movable relatively to said cradle, a grip chain secured to said chocking block and adopted to be released by the movement thereof, and means for moving said chocking block. Four claims.

1,071,735. ICE-BREAKING MARINE VESSEL. BENJAMIN T. HAAGENSON, OF ASHTABULA, OHIO.

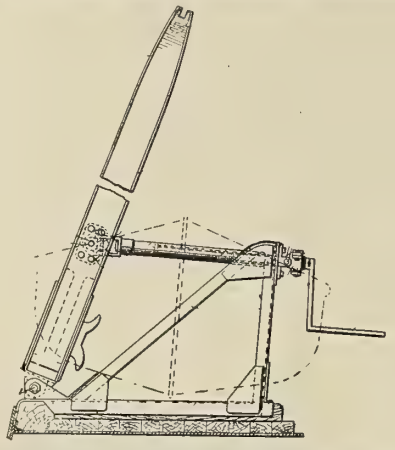
Claim 1.—The combination, with a marine vessel, of controllable means operating on opposite sides of the keel or medial line for imparting a rocking or oscillating movement to said vessel, and mechanism whereby said means is caused to reverse the direction of its action upon the vessel at regular and predetermined intervals of time. Six claims.

1,071,393. BUOY FOR SUBMARINE BOATS. DANIEL L. CAYO OF WOOSTER, OHIO.

Claim 1.—The combination with a submarine vessel, having a cradle formed in its upper surface, of a buoy provided with a frame, a hollow reel mounted in said frame, a hollow stationary hub carried by the frame and upon which an end portion of said reel is mounted, a cable adapted to be secured at one end to the submarine vessel and passing into said hollow reel and out through said hub and thence upwardly to the top of the buoy and suitable electrical conductors arranged within said cable. Two claims.

1,071,783. BOAT DAVIT. HAROLD FREDERICK NORTON OF NEWPORT NEWS, VA.

Claim 1.—A davit supported by a pivot at its lower end, and means for oscillating said davit comprising two substantially horizontal members con-

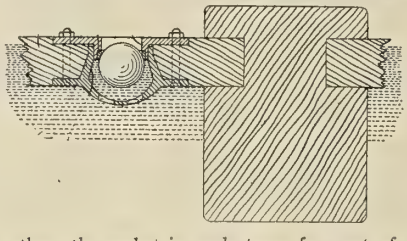


nected by a nut and long screw, one member being non-revoluble and directly swiveled to said davit intermediate its ends, the other member being revoluble, and a fixed deck-stool having a bearing swiveled for universal movement in which said revoluble member is thrust-journaled, its outer end extending through the bearing and provided with means for effecting rotation. Five claims.

British patents compiled by G. E. Redfern & Company, chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 21 Southampton Building, W. C., London.

20,482-1912. IMPROVEMENTS IN BOAT PLUGS. H. R. HOWE, OF SMITHDOWN ROAD, LIVERPOOL.

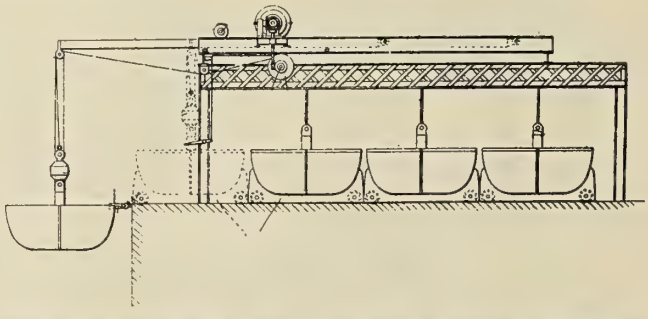
Claim.—An improved automatic plug device for ships' boats comprises a valve chamber formed of two plates adapted to be clamped to the boat bottom, and provided with a sleeve on one plate spigoted into a hollow



socket on the other; the socket is made taper for part of its length and with parallel sides for the remainder, while the sleeve has a waterway through it with parallel sides so as to receive an ordinary plug when required, and has at its extreme end a valve seat against which a spherical valve automatically seats itself when raised by the pressure of water.

18,339-1912. LAUNCHING BOATS AND THE LIKE FROM SHIPS. W. D. KEY OF CAMBERWELL GATE, LONDON.

Claim.—This invention relates broadly to appliances for launching boats from ships in which the lowering tackle is carried upon horizontal sliding arms mounted in guides on a framework upon the deck of the vessel and adapted to be projected beyond the sides of the vessel when



required for launching the boats. Each boat is launched by being projected from the end of the arm which is then projected beyond the side of the vessel, the arms and lowering tackle both being operated from a single stationary motor.

1,071,835. LIFEBOAT. CHARLES WILLIAM WALLIS OF TORONTO, ONTARIO, CANADA.

Claim 1.—In a nested boat, opposing seats comprising arc-shaped brackets pivotally connected at their lower end to the inside of the boat and adapted to fold against and fit the inside of the boat, flexible seats secured at one end to the side of the boat and at the opposite end to the top of the brackets, and means for securing the opposing brackets together. Two claims.